AVIATION WEEK

NOV. 30, 1953

50 CENTS

Should the need arise again, the Cougar jet fighters above, plus other new Grumman Aircraft, will play as big a role in victory as did Panther jets in Korea . . . as did Grumman Wildcats, Hellcats and Avengers of task force fame in World War II.

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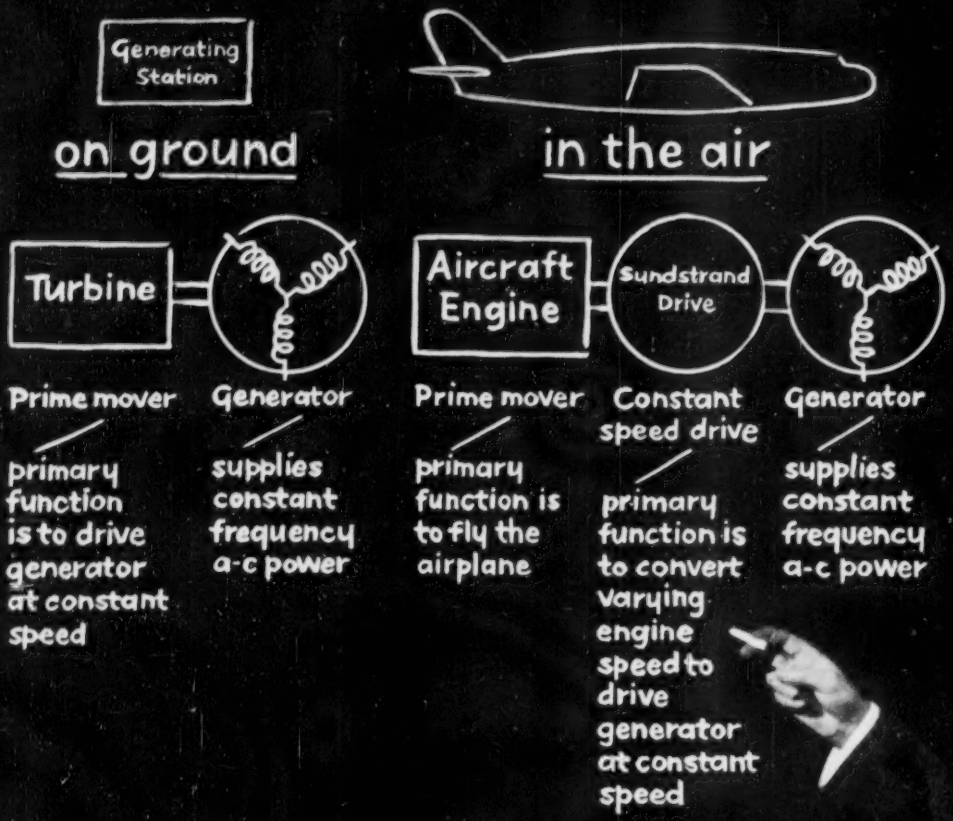

How Sundstrand helps solve puzzling power problems...

Seasoned engineers in the aircraft industry have lived through many experimental systems developed to provide constant frequency AC power in the air. Of all those tried, only one has run the gantlet successfully . . . the Sundstrand Constant Speed Drive system.

On the ground, the generation of constant frequency AC power is relatively simple. Prime movers have been developed for one purpose only . . . to drive the generator at constant speed, regardless of the variance in electrical demand. Speed of the prime mover is automatically varied to keep the generator operating at constant speed to meet all load conditions. The prime mover and generator are made for each other, custom-built as a team to work together.

In the air, however, the prime mover is designed primarily to fly the airplane. Only on a secondary basis is it called upon to drive the generator. And, with engine speeds ranging from idling to full military power, the problem of driving an aircraft generator at constant speed under all load conditions is intensified.

In aircraft, the Sundstrand Constant Speed Drive transforms the varying speed of the engine to constant speed for driving the AC generator. New adaptations of the drive are being made daily to help engine and airframe manufacturers solve problems of mounting, power take-off, oil supply, etc. Constant improvements are being made to assure a mechanism as trouble-free and as long lasting as the modern engine.

Help on your power generation problem from experienced Sundstrand engineers is yours for the asking. Phone, wire, or write us today.

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RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

New De-Icers work faster to keep wings ice-free

THE RUBBER STRIPS seen around the leading edges of the wing above are B. F. Goodrich De-Icers. They are made with five wide tubes that inflate and deflate, effectively break off ice on planes like this TWA Constellation.

To give this protection to today's bigger . . . and faster planes, B. F. Goodrich years ago started testing hundreds of De-Icer designs under the toughest weather conditions. This included icing tests in actual service over the north Atlantic. So when the Navy needed special De-Icers for fast fighters for Korea, B. F. Goodrich was able to design, test and produce them in 21 days.

The latest BFG De-Icer development is the one with narrow ¾″ tubes, now used on TWA and Eastern Airlines Super Constellations. These little tubes inflate quicker with almost three times the air pressure used on earlier types. This breaks off ice cleaner and faster. The rest period between inflating cycles is much longer, cutting down disturbance of the airflow so much it isn't even a factor. This new De-Icer is lighter—takes up little space for plumbing.

Airlines report that these De-Icers last twice as long, too. That's because they're molded to fit, simply cemented onto the plane with no stretching, no tension.

First developed by B. F. Goodrich, De-Icers have given the airlines year-round protection against icing conditions since 1930. B. F. Goodrich engineers have the longest, most complete background of experience in the field of airplance ice protection. Let them put this experience to work for you.

Other B. F. Goodrich products for aviation include: tires, wheels, brakes; heated rubber; Avtrim; Plastilock adhesives; Pressure Sealing Zippers; canopy seals; fuel cells; Rivnuts; hose and other accessories. *The B. F. Goodrich Co., Aeronautical Division, Akron, Ohio.*

B.F.Goodrich
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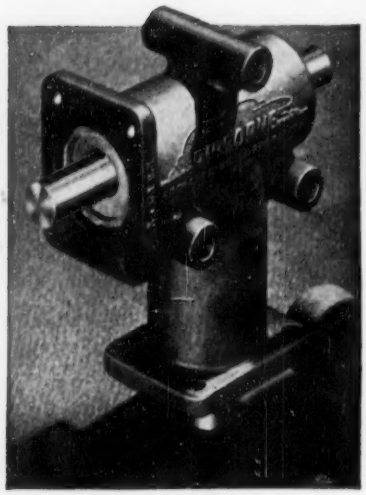
Right angle
TRANSMISSION PROBLEM
?



Before spending time and money on a tailor-made design, investigate ANGLgear. You'll learn why these tiny right-angle bevel gear drives are so widely used. ANGLgears have the capacity of units many times their size. Model R-300 is rated at 1/3 hp at 1800 rpm—Model R-320 at 1 hp. Both models have hardened gears and ball bearings, are lubricated for life. Both are made with 1:1 ratio, and with 2-way or 3-way shaft extensions.

ANGLgears are described fully in the I. A. S. Aeronautical Engineering Catalog. Refer to this publication for complete information, or write us direct.

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Aviation Week

Volume 59 — November 30, 1953 — Number 22

Editorial Offices: 330 W. 42nd St., New York 36. Tel. Longacre 4-3000
National Press Bldg., Washington 4, D. C. Tel. National 8-3414
1111 Wilshire Blvd., Los Angeles 17, Calif. Tel. Madison 6-4323

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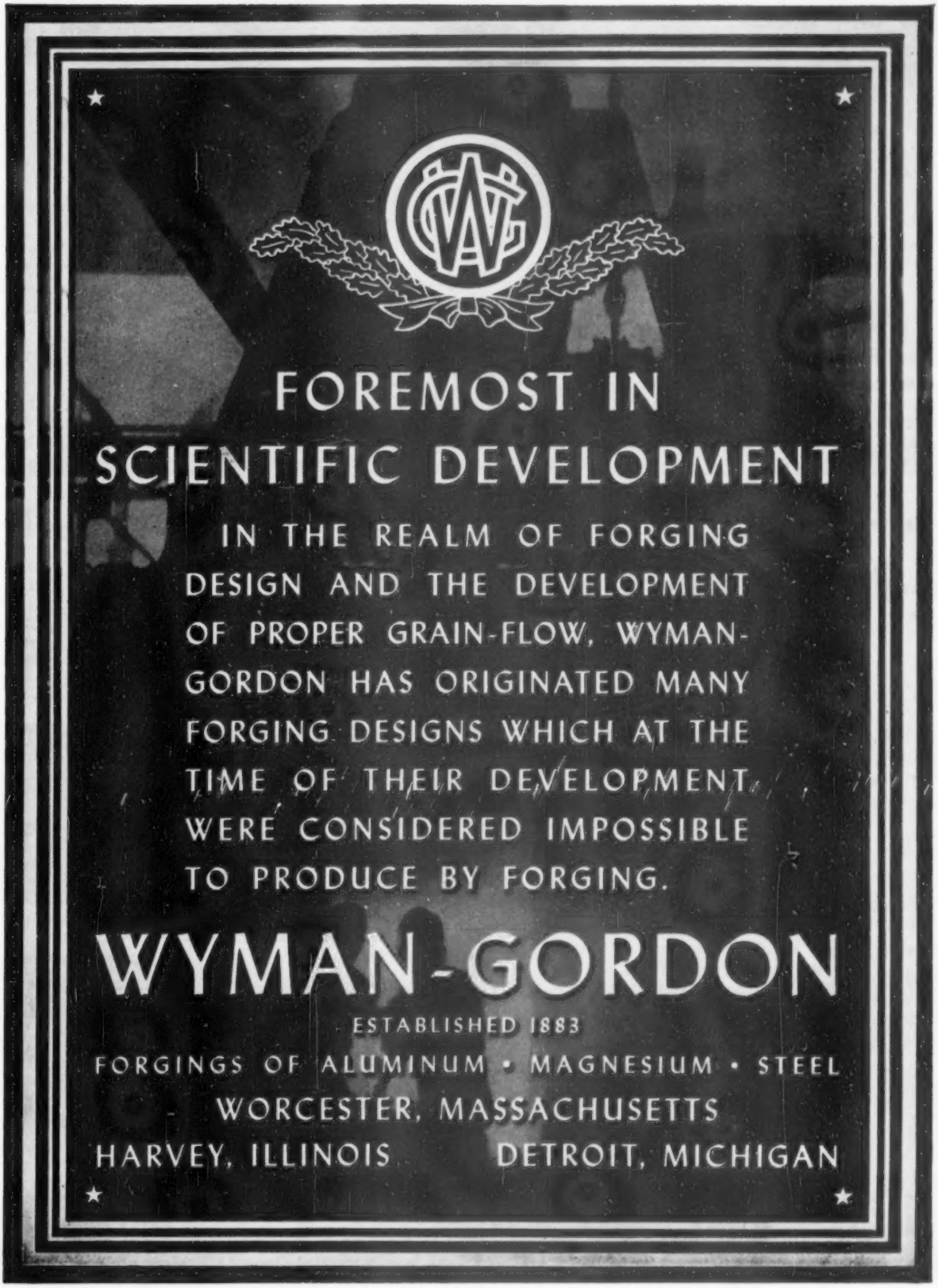
ABP — **AVIATION WEEK • November 30, 1953 • Vol. 59—No. 22**
Member ABP and ABC — ABC

Published weekly by McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. **Publication Office: 99-129 North Broadway, Albany 1, N. Y.**
Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.
Subscriptions: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow 10 days for change of address.
Subscriptions are solicited only from persons having a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.
Single copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par; other Western Hemisphere, $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Entered as second-class matter, July 16, 1947, at the Post Office at Albany, N. Y., under Act of Mar. 3, 1879. Printed in U. S. A. Copyright 1953 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved. Cable Address: "McGraw-Hill New York." Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.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NEWS DIGEST

Domestic

U. S. air power now totals approximately 92,579 airworthy aircraft, of which 39,936 are military and 52,643 commercial, reports James H. Smith, Jr., Assistant Secretary of the Navy for Air.

Aircraft workers receive an annual payroll totaling more than $3.2 million a year and make up the second largest working force in the country, according to Aircraft Industries Assn.

Civil aircraft shipments totaled 359 complete planes valued at $21 million during September, an increase of nine airframes and $3 million over August, Civil Aeronautics Administration and Bureau of Census report. The aircraft boosted total value of shipments during the first nine months of 1953 to $162.4 million. Civil aircraft engines added up to 465 units at a total horsepower of 418,000, a 24% drop in number but a 10% increase in power. Total value of engines: $7.2 million.

Lightplane producers exported 64 aircraft valued at $496,916 last month, increasing the total for the first 10 months of 1953 to 508 units at $3,745,276, according to Aircraft Industries Assn. Companies reporting: Beech, Cessna, Piper and Taylorcraft.

Hamlin B. Johnson, executive director of Aircoach Transport Assn., is new president of nonscheduled airline organization. New ACTA board of directors: Otto Morrow, Meteor Air Transport; Adam G. Thomson, Jr., Argonaut Airways Corp.; Shield B. Craft, Standard Airways; Gus Callas, General Airways; Robert D. Jones, U.S. Overseas Airlines, and Roy C. Briten, Westair Transport.

Strategic Air Command's 22nd Bomb Wing of B-47 medium jet bombers took off on a 5,000-mi. flight to England from March AFB, Calif., last week to replace the 305th, scheduled for rotation back to its home station at MacDill AFB, Fla.

Volney C. Finch, 61, jet propulsion authority and mechanical engineering professor at Stanford University, died this month in Palo Alto, Calif.

New assignment of the aviation gas contract at New York's Idlewild International Airport gives operation of the fuel facilities to Allied Aviation Fueling of New York, Inc.

Tail Chute Brakes Super Sabre Landing Run

New North American YF-100A Super Sabre pops its tail parachute to slow its ground travel. Tail chute is particularly valuable for emergency landings after travel or operations into small fields. First production model of the Super Sabre came off NAA's lines Oct. 20. The supersonic USAF fighter is powered by a PWA J57 split-compressor jet in the 10,000-lb.-thrust class having an afterburner.

Aviation memorial site at New York's historic Roosevelt Field last week was offered to the air industry by Webb & Knapp, Inc. The realty company put a Jan. 1 deadline on the offer, first made three years ago.

Financial

Lockheed Aircraft Corp., Burbank, Calif., reports net earnings of $12,515,000 for the first three quarters of this year, nearly two-and-a-half times the $4,944,000 net of the first nine months of 1952. Sales and other income totaled $580,601,000, compared with $287,266,000. Backlog increased 40% to $1,522,341,000.

Curtiss-Wright Corp., Wood-Ridge, N. J., had a consolidated net profit of $8,058,376 from sales totaling $317,885,461 for the nine months ended Sept. 30. This compared with a $5,214,770 net and $214,211,056 in sales during the same period last year. Backlog and letter contracts: more than $900 million.

California Eastern Airways and its wholly owned subsidiaries ended the first nine months of 1952 with a total net profit of $988,000, dropping $96,000 from the same period of last year. The net included capital gains totaling $1,023,000 on sale of equipment and a net loss on operations of $5,000, compared with gains of $814,000 and an operations net of $265,000 in 1952.

Republic Aviation Corp., Farmingdale, N. Y., has declared a dividend of 75 cents and 10% in stock on common shares, payable Dec. 22 to stockholders of record Dec. 1.

Northrop Aircraft, Inc., has declared a 25-cent dividend on capital stock, payable Dec. 11 to shareholders of record Nov. 30.

International

Atomic aircraft engine will be developed from a small British bomb capable of producing a "miniature" explosion, Britain's plane manufacturers predict. They expect the bomb to lead the way in solving the problem of getting nuclear reactor units small and light enough to fit into aircraft.

British aircraft exports amounted to $137.2 million during the first nine months of 1953, an increase of approximately $14 million, Society of British Aircraft Constructors reports.

De Havilland Aircraft of Canada is taking over maintenance and overhaul of General Electric J47 jet engines used in RCAF F-86 Sabres. The company will move into a special $2-million plant built by the government and used until now by Canadian General Electric for J47 work.

Rafael Arraiz, president of LAV Venezuelan Airlines, was killed this month by a former airline employe charged with embezzling company funds.

Appropriations for military aviation in Italy will total $135 million during fiscal 1953-54, estimates now before Parliament reveal.

DH Comet service has been inaugurated between Paris and Johannesburg, South Africa, by Union Acromaratime de Transport on a 17-hr., three-stop schedule—compared with 21-hr., six-stop service offered by BOAC Comet flights.

The Grumman S2F-1 is the first carrier aircraft combining the elements of submarine search and attack in one airplane. It is the Navy's most modern way of hunting out enemy submarines.

SCHWEIZER is proud of its part in assisting with the production of this deadly sub-killer . . . another example of versatile engineering and manufacturing in addition to making the internationally famous SCHWEIZER sailplanes.

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ELMIRA, NEW YORK

The Aviation Week

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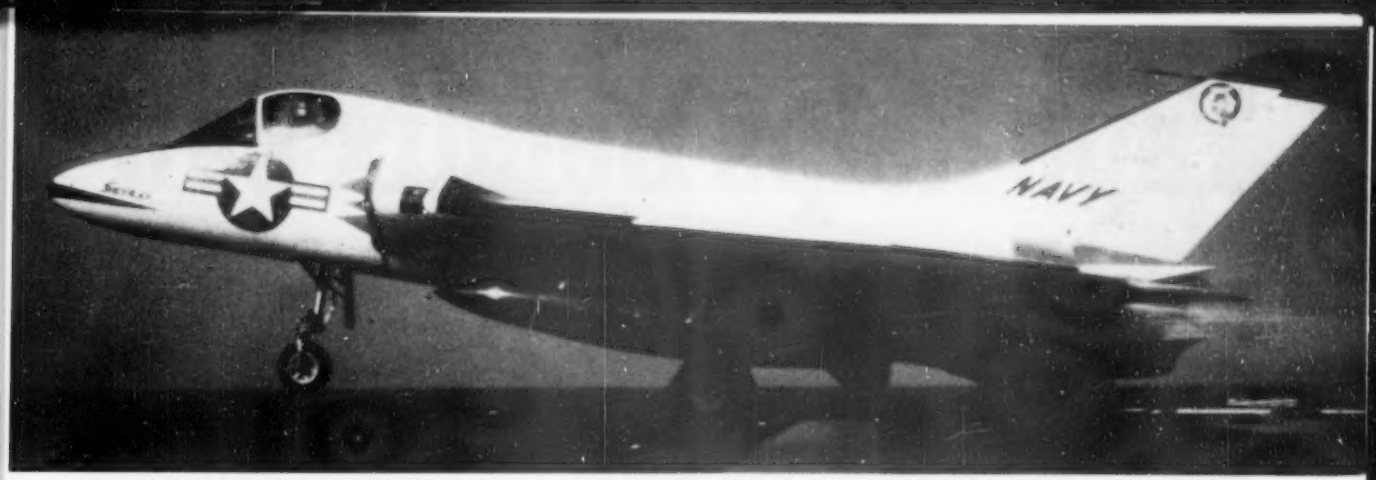
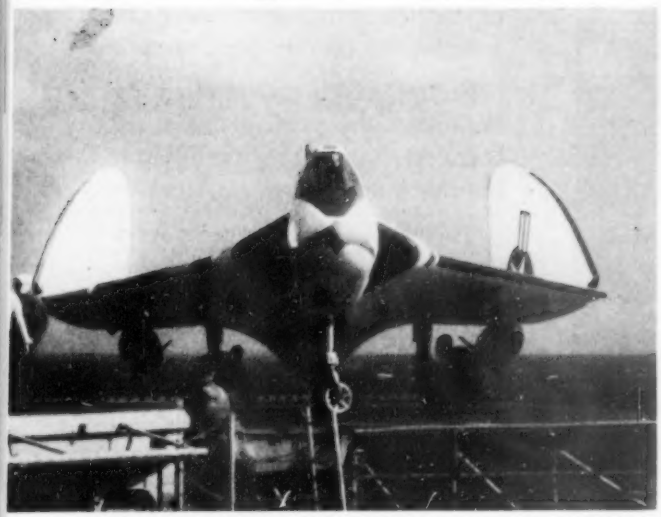
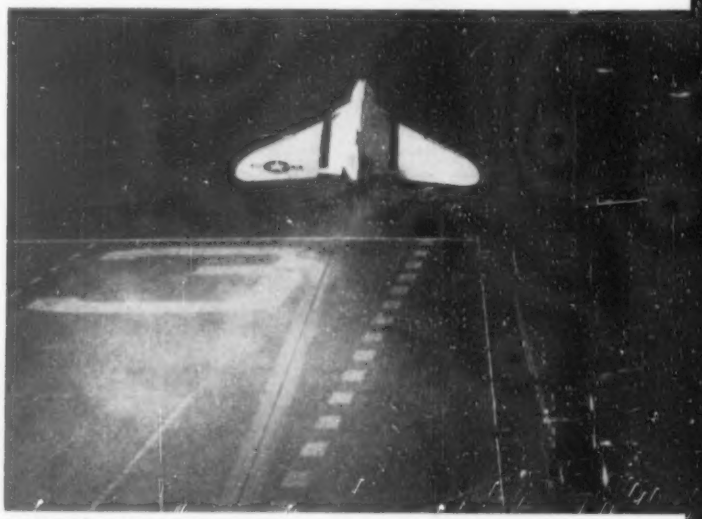


SKYRAY CATAPULTED—Douglas XF4D-1 Skyray is hurled over the rim of the deck of the USS Coral Sea by catapult's explosive charge during carrier qualification trials off Norfolk, Va. Note streamlined stores container on underwing rack. (Carrier trials story p. 18.)

700-Mph. Skyray Tests Its Sea Wings

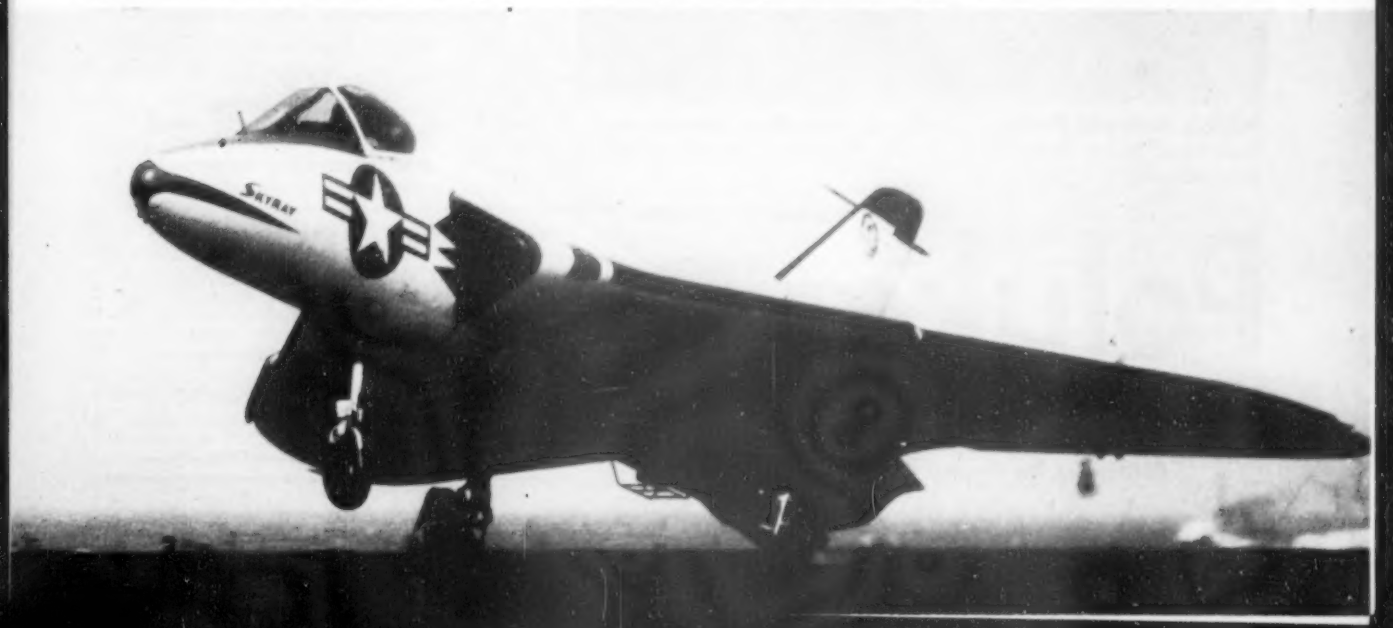


ON THE ELEVATOR—Wings folded for compactness, the 700-mph.-plus Skyray perches on the Coral Sea's deck-edge elevator.

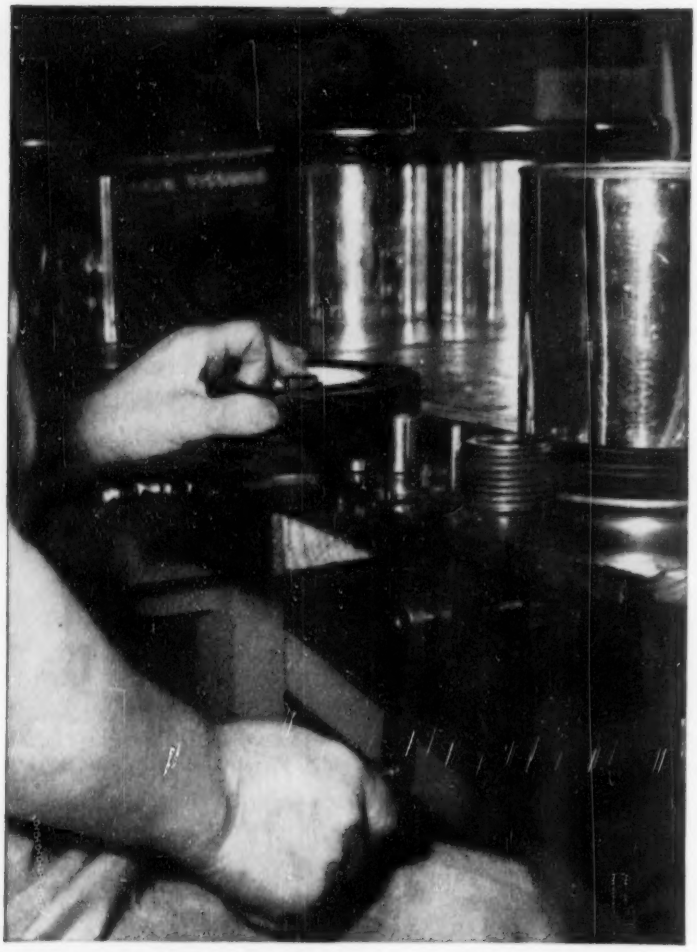


TAKEOFF—Skyray's low-aspect-ratio wings are highlighted in rear view of fighter being catapulted. Elevators are on each side of tail.

SCORING A TOUCHDOWN—F4D's main landing gear hits the Coral Sea's deck during a landing trial. It is not carrying its bomb-like containers. The single-seat fighter made approximately 30 landings and catapult takeoffs during its carrier tests



Tape helps Bendix "can" small aircraft parts



Polyken Tape No. 214 seals the lids on "canned" aircraft parts at these taping tables. Even the largest cans are sealed in approximately eight seconds.

Field mechanics at U. S. Navy and Air Force bases used to receive small repair parts packed together in cardboard cartons. This method did not provide perfect protection during shipping and left the unused parts exposed to damaging moisture and grit after the cartons were opened.

Bendix solved this problem by "canning" the parts in special tin containers—and sealing the lids with reusable Polyken Tape No. 214.

This Polyken Tape provides a strong, weatherproof seal that conforms to government specifications JAN-P-127, Type 1 Grade B. And because Polyken Tape No. 214 has excellent adhesion and tack, the same piece of tape that makes the original seal can be used again by merely pressing it back around the lid.

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WHO'S WHERE

In the Front Office

Maj. Gen. Arthur Thomas, retired commander of Air Materiel Command's Eastern Air Procurement District, is new vice president of Machine & Tool Designing Co., Philadelphia.

Dale A. Lichty, vice president-sales and engineering for Hydro-Aire, Inc., has been elected to the board of the Burbank, Calif., aircraft accessories firm. **L. E. King** has been appointed project engineer in charge of transistor research and development.

Lynn Eaton has become vice president-sales of National Co., electronics firm at Malden and Melrose, Mass.

Edward G. Littel, former legal representative for Fairchild Engine & Airplane Corp.'s Aircraft Division, is new assistant to the president of Vitro Corp. of America, New York.

Changes

Charles C. Busenkell has been appointed executive engineer for Continental Aviation & Engineering Corp.'s West Coast operations at Sherman Oaks, Calif.

John J. Farrell has been named general manager of General Electric's new heavy military electronic equipment department at Syracuse, N. Y., and **Herman F. Konig** is general manager of the light military electronic equipment department, Utica, N. Y.

John N. Eustis has become procurement director for Piasecki Helicopter Corp., Morton, Pa. Other changes: **David M. Nason,** assistant director of procurement; **Charles F. Hazzard,** manager of subcontracts, manufacturing.

Forrest F. Hinkley has been promoted to director of subsidiary operation for Aeroquip Corp., Jackson, Mich. **Horace B. Ferguson** is new purchasing director.

Nils H. Lou has been appointed chief manufacturing engineer at Republic Aviation Corp., Farmingdale, N. Y.

George E. McKusick, former chief advisor of Civil Aeronautics Administration's New York International Office, has joined Lockheed Aircraft Service as service salesman.

Honors & Elections

Ralph S. Damon, president of Trans World Airlines, has received the American Legion's Award of Merit for his contributions to aviation.

Raymond C. Blaylock, assistant chief engineer for Chance Vought Division of United Aircraft Corp., has been cited by the University of Michigan for "outstanding achievements and contributions to the development of engineering." **D. G. Andreoli** and **Jack Boucher,** assistant project engineers at C-V, have been elected chairman and secretary for the Texas section of the Institute of the Aeronautical Sciences.

W. D. Parker, manager of aviation sales for Phillips Petroleum Co., is new chairman of the Aviation Technical Service Committee of the American Petroleum Institute's Division of Marketing.

INDUSTRY OBSERVER

► North American Aviation, Inc., and Douglas Aircraft plan to continue their rivalry for speed records, pitting the A3D twin-jet bomber and the F-100 supersonic fighter in a battle for a new transcontinental speed record. F-100 is a faster plane but will have to stop for refueling on the transcontinental route. A3D can make the trip in one hop. Present record for single-seater jets is 4 hr. 13 min. set in 1946 by Col. W. H. Councill in a Lockheed F-80. There is no official transcontinental record for multi-jet military aircraft, although in 1949 a Boeing B-47 flew nonstop from Moses AFB, Wash., to Andrews AFB, Md., a distance of 2,289 mi., in 3 hr. 46 min.

► **Problem for avionics manufacturers is reducing the mobile equipment required to operate guided missiles in the field. One Army bombardment missile now requires 13 supporting avionic and supply vehicles for field operations, making it even more cumbersome logistically than the Army's 280-mm. atomic cannon.**

► First Vickers Viscount from the firm's new production line at Hurn, England, is due to fly soon. It will be the 25th production model produced by Vickers. Viscount still is proving tough competition for the Convair 340 in the international airline market.

► **Loftleidir, Icelandic Airlines, is interested in establishing a domestic helicopter passenger service in Iceland. Its executives are querying operators of Sikorsky S-55 machines on their experience with these eight-passenger helicopters.**

► Weight difference between General Electric J47 and Rolls-Royce R.A. 7 Avon posed a design problem to Australian engineers converting the Sabre airframe to Avon power. New powerplant had to be moved aft to correct CG location. Tailpipe had to be shortened correspondingly.

► **English Electric's design for a DC-3 replacement—one of several current proposals in the British industry—calls for a Double-Mamba turboprop powerplant. If Air Registration Board decides that this qualifies the design as a twin-engine craft, the firm will proceed with the detailing.**

► USAF has made no official announcement on the cause of the crash of the Bell X-5 research plane at Edwards AFB Oct. 13, but informed sources say the accident that killed test pilot Maj. Raymond Popson was the result of a spin at about 12,000 ft., from which the plane never recovered. Despite repeated radio pleas from his chase pilot to bail out, Popson rode the plane to the ground. The X-5 was used for testing variable angles of sweepback on wings.

► **American and British designers are looking to the gas generator (compressor and combustion units of a gas turbine) as a powerplant for helicopter, convertiplanes and some types of fixed-wing aircraft. For helicopters, the hot gas would be used to drive rotor tips. For fixed-wing aircraft, the gas would drive a remote turbine geared to a propeller. For convertiplanes, a gear box would shift the power required from rotor to propeller. Percival Aircraft has a helicopter project and a DC-3 replacement designed around the gas generator and Fairey Aeroplane, Ltd., has planned a large helicopter around this type powerplant. U.S. designers also are experimenting with this principle.**

► A carrier-based aircraft "of advanced design" is being designed by W.E.W. Petter at Folland Aircraft in England. Petter, who designed the English Electric Canberra, currently also is supervising construction of the Gnat, Folland's lightweight fighter expected to fly late next summer.

► **Commercial version of Sikorsky's new, twin-engine helicopter, the S-56, will have accommodations for 35 passengers and a crew of two, according to United Aircraft Corp. This is under shorthaul conditions and makes allowance for 35 lb. of baggage per passenger.**

► Aircraft industry is producing 13 civil planes a day even though military production accounts for 90% of the industry's activities.

Washington Roundup

President's Decision

Final decisions on the fiscal 1954 military budget will be made personally by the President. Members of National Security Council will present their views at final sessions early in December. Decisions will not be by council votes, however. They will be made personally by the President—possibly even against majority advice of NSC.

This year there was confusion on the President's position on defense cuts, particularly a $5-billion reduction in Air Force funds. A belated letter from the President on the eve of House consideration explicitly supporting reductions in the Truman-proposed defense budget is given chief credit for defeating moves to restore cuts.

Next year there will be Presidential support for the defense budget from the outset.

Foreign Military Aid

Money for foreign military aid probably will be included in the defense budget next year, instead of being submitted as a separate item. It is felt that it will be less susceptible to congressional slashing under a "defense" category than under a "foreign aid" listing.

$2-Billion Air Defense?

An Administration request for a $500-million supplemental appropriation to start a major continental defense program rolling will touch off a fight in Congress. Rep. John McCormack, House Democratic Whip, will lead a move to increase it to $2 billion.

Single R & D Fund?

Assistant Secretary of Defense Donald Quarles emphasizes that "the existing momentum of the three services in research and development must be maintained" and that "there must be a large degree of decentralization." However, raising the question of one overall Defense Department appropriation for research and development, he says:

"There is no single overall research and development appropriation for the Defense Department as a whole. Within the total of the various appropriations, we have very limited freedom in shifting funds from one agency to another, even when subsequent changes in requirements might make such transfers desirable. Our system of budgeting, appropriating, obligating, and then performing is not as flexible as good R. & D. administration would call for."

White on McNeil

Assistant USAF Secretary H. Lee White is out of step with Air Force proponents who point to Defense Department's Comptroller W. J. McNeil as one who has long tried to scuttle Air Force programs and this year succeeded in selling a $5-billion slash in USAF money to the new Administration.

White volunteered to a congressional committee: "Secretary McNeil, because of his length of service coupled with his ability, has been capable of doing an outstanding job and building around himself an excellent organization."

Critics point out that White, as well as McNeil, is a Naval Reserve officer.

Guided Missile Ships

Introduction of guided missiles into the fleet will not pose a new ship construction problem for the Navy. Chief of Naval Operations, Adm. Robert Carney, sees no requirement for new ship types for missile launching:

"We don't need to build a special guided missile ship. We have a lot of good, rugged hulls around like battleships, battle cruisers, and some heavy cruisers which can be converted to missile launching."

Murray Controversy

Undersecretary of Commerce for Transportation Robert Murray will be a controversial figure in the next congressional session. Substantial opposition, including Republicans, to his new policies in Civil Aeronautics Administration activities is evident. There may be a move to re-establish CAA as an independent authority, but the chance of enactment of such legislation seems to be virtually nil. Hearings would give some members an opportunity to express their dissatisfactions. Murray's actions to cut back CAA activities, though, undoubtedly will be supported strongly by House appropriations committeemen, long critical of the agency.

Feeders Miss Opportunity?

Local service airlines seem to be overlooking one prospect for willing political support: Senate Small Business Committee. Small line representatives have criticized the group privately for championing the nonskeds' position as "small business" and ignoring small lines' problems.

The committee's staff director, Laurance Henderson, reports the committee considers the local lines "genuinely small business"—but that the lines have never placed their major problems before the committee.

Local service spokesmen say it is true they have never called on the Small Business Committee for help. In fact they appeared before the committee two years ago informing it that Civil Aeronautics Board was doing a good job in helping small business, having set up and fostered growth of the 17-airline local service industry. Main worry of the locals now is that the Administration's economy program may cut their subsidies.

CAA Jobs

Senate Post Office and Civil Service Committee, headed by Sen. Frank Carlson, may launch an investigation to determine whether Civil Service Commission is keeping jobs under Civil Service classification that should be policy appointments. Target of some Republicans is the commission's Republican chairman, Philip Young, who held a wide range of key posts in the Roosevelt Administration and has voted consistently with the Democratic member, Frederick Lawton. Republican member George Moore has been the minority. Because of rigid rules laid down by CSC, Commerce Department asked for removal of only eight CAA jobs from Civil Service for policy appointment. It was turned down for two: information director and information assistant.

—Katherine Johnsen

AVIATION WEEK VOL. 59, NO. 22
NOVEMBER 30, 1953

Douglas Skyrocket Reaches Mach 2.01

- **NACA test pilot Crossfield pushes research aircraft close to peak performance despite severe turbulence.**
- **Record flight encounters control problems, described as aggravated versions of those in transonic zone.**

By Robert B. Hotz

Los Angeles—Scott Crossfield, 32-year-old test pilot for the National Advisory Committee for Aeronautics, became the first man to fly twice the speed of sound (Mach 2) when he pushed the Douglas Skyrocket 1,327 mph. at an altitude of 65,000 ft. over the Mojave Desert.

The Skyrocket's epochal performance was the climax of a joint program of research into supersonic flight started by NACA, Air Force and Navy ten years ago. The record breaking flight came just a little more than six years after the program produced the first piloted flight to exceed Mach 1 by Maj. Charles Yeager in the Bell X-1.

▶ **Severe Turbulence**—Crossfield made his record run shortly after noon Nov. 20 in the face of severe high-altitude turbulence from a passing cold front, and despite suffering from a bad cold and stomach ache. Announcement of the Mach 2 flight was delayed 24 hr. while NACA experts recorded and checked data gathered by the highly instrumented research plane.

The Skyrocket was carried aloft by a Boeing B-29 mother plane which took more than an hour to lift the 15,000-lb. research aircraft to launching altitude after the takeoff from the paved runway at Edwards AFB where NACA conducts its highspeed flight research.

After cutting loose from the B-29 at 32,000 ft. Crossfield used two of the four Reaction Motors' rocket tubes for a 30-deg. climb, steepening to 45 deg.

On reaching the desired altitude, Crossfield carefully executed a Zero Gee pushover preparatory to a maximum speed run with all four rocket tubes putting out maximum 6,000 lb. thrust.

The speed run was made in a shallow dive with the temperature about −67F. Crossfield told AVIATION WEEK he saw the Mach meter register over Mach 2 for five to ten seconds with a maximum reading of Mach 2.01.

▶ **Control Problems**—Severe control problems associated with earlier high-speed Skyrocket flights were encountered by Crossfield, but he declined to reveal further details. NACA scientists indicated that the problems of supersonic control were similar to those encountered in the transonic zone but aggravated by higher speeds.

Flight was the 51st made by Crossfield in the Skyrocket and came only a few weeks after he set a new unofficial speed record of 1,272 mph. (Mach 1.96) in the same plane. The record flight was a deliberate, carefully planned and precisely executed attempt to push the frontier of piloted flight to Mach 2. It required exact adherence to a predetermined flight plan, combining such critical factors as fuel, altitude and power to produce the maximum result.

Crossfield flew one of the three Skyrockets built by the El Segundo Division of Douglas which had turbojet and jet fuel tanks removed to provide additional alcohol and liquid oxygen fuel for rocket motor.

▶ **Three Tons of Fuel**—This Skyrocket had three tons of rocket fuel giving three minutes of endurance at full power. Total flight time from the B-29 drop to the landing on Rogers Dry Lake bed was 12 minutes with eight consumed by the glide home after the fuel supply was exhausted. There were only four minutes of powered flight available for the speed run.

NACA scientists told AVIATION WEEK that Crossfield had pushed the Skyrocket very close to the limit of its performance and that much higher speeds cannot be expected in the future. However, continued Skyrocket supersonic flights will add much valuable new data. The Skyrocket has made about 200 flights with Douglas, military and NACA pilots since 1948.

The military aircraft industry has received 8,500 scientific reports of the Skyrocket flight testing for use in designing supersonic combat planes. An indication of how close actual combat planes are pushing the heels of research results is apparent in the Convair F-102 all-weather interceptor which is designed for a performance of Mach 2. F-102 has made its first test flight and already is scheduled for production.

SKYROCKET RECORD TRIO: Scott Crossfield (center), NACA pilot who flew the Douglas D-558-II to a new speed mark (1,327 mph.) Nov. 20, with two other Skyrocket record breakers: Douglas test pilot Bill Bridgeman (left), who set a previous speed record of 1,238 mph. Aug. 7, 1951, and Marine Corps Lt. Col. Marion Carl, who set the Skyrocket altitude mark of 83,235 ft. last Aug. 21.

▶ **Typical Example**—Crossfield is a typical example of the combination scientist-pilots at the NACA highspeed flight research station who have contributed so much to the knowledge of supersonic flight. He has a master's degree in Aeronautical Engineering from the University of Washington, and was a Navy pilot during World War II. He worked as a windtunnel computer and chief operator at the University of Washington's aero lab. There he did work on a number of highspeed fighter designs, and the Boeing B-47 Stratojet bomber.

He has been with NACA since 1950 and has flown a variety of jet fighters, multi-jet bombers and copters. In the highspeed research program, he has flown the delta-wing XF-92A, Northrop X-4, Bell X-1 and X-5 and the Douglas Skystreak.

He also is the author of several scientific reports on highspeed flight. At least 40 men deserve a share of the credit attached to this flight, Crossfield said. "I guess maybe I should increase that figure to include every man and

woman at the NACA highspeed flight research station—they all had a part in the preparation and execution of my research flight."

► **Enormous Dividends**—The Skyrocket was designed by the engineering staff of Douglas' El Segundo Division, headed by Ed Heinemann. It was financed by the Navy as part of the joint research program conceived in 1943 by NACA, Air Force and Navy and organized in 1944.

Contracts for the research planes were let in 1945. The program has paid enormous dividends in the production of highspeed jet bombers, and the supersonic Series-100 fighters built by North American, McDonnell and Convair for the USAF and Navy fighters built by Douglas, McDonnell and Vought.

The Skyrocket contract was let after VJ day in the summer of 1945 and the mockup approved in March 1946. The first plane was finished in November 1947, 20 months after the contract was let. The first flight was made Feb. 4, 1948, and the actual aircraft performance of the Skyrocket doubled the original Navy specs requiring Mach 1.

Heinemann pointed out that the Skyrocket's wing design is a conventional subsonic type with rounded leading edges and contours, and not the supersonic knife-edge type. Wing and tail surfaces are largely 75ST aluminum with the fuselage skin made of magnesium.

It carries 625 lb. of specially designed instruments.

► **Industry Impressed**—Aircraft industry was impressed with the combination of the Douglas design and the pilot's skill that produced Mach 2 in actual flight from a plane originally built to go only half that fast.

The supersonic research program is scheduled to be augmented soon with two more planes capable of Mach 2-or-better performance. They are the Bell X-2 which is built of stainless steel with a sweptwing design and powered by a 12,000-lb.-thrust Curtiss-Wright rocket engine; and a new version of the Bell X-1 with turbo pumps replacing the nitrogen pressure fuel system of the earlier versions that made the first supersonic flight. New pumps double the rocket fuel capacity of the X-1 which is aimed at a maximum speed of 1,700 mph.

Titanium Hearings Start Second Round

Expansion of titanium production is a major problem facing defense planners (AVIATION WEEK Oct. 26, p. 14).

If airframe output should reach the World War II peak of 1,141 million pounds a year in an emergency, production of 171,100 tons of titanium annually—or 30% of the total airframe weight—would be desirable at this time. In addition, manufacturers estimate that 30% of engine weight should be in titanium.

This year, production is expected to be less than 2,500 tons.

Recent developments:

• **Several firms** not now engaged in titanium production—including Harvey Aluminum Co., Kaiser Aluminum Co., Monsanto Chemical Co., Electro-Met Co., Horizones Titanium Corp.—have developed improved processes for ingot production.

National Academy of Science now is evaluating some of these. Government financing of additional capacity hinges on the outcome.

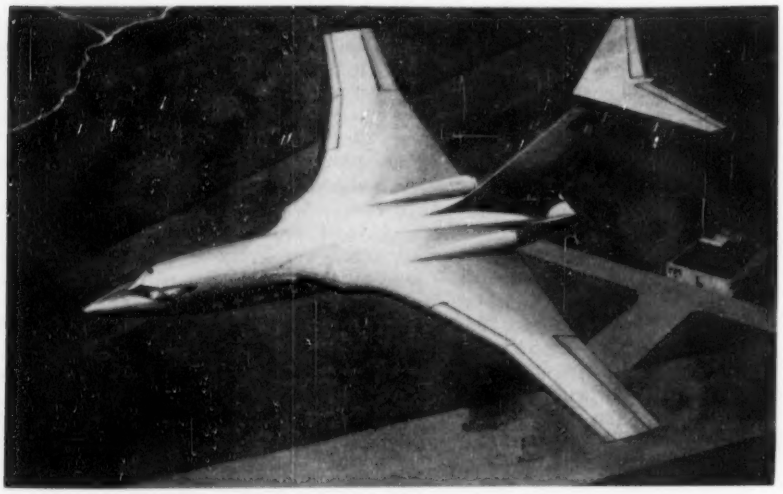
So far, the government has contracted for an increase of only 13,000 tons a year out of the authorized annual boost of 25,000 tons.

• **Commerce Department's** Business Defense Services Administration and Office of Defense Mobilization are launching a drive to obtain titanium scrap for re-processing.

An estimated 40% of titanium production winds up as scrap at aircraft manufacturers' plants and much of this is going to waste because of mixture with other scrap metals. Government wants manufacturers to turn scrap back to titanium mills directly, instead of selling it to dealers.

• **An inter-departmental committee** to coordinate experimental research on titanium is being organized under Assistant Secretary of Defense for Research and Development Donald Quarles. The three services and National Academy of Sciences will be represented. Industry may be asked to participate at a later date.

• **Senate's Strategic Metal** Subcommittee, headed by Sen. George Malone, last week started a second series of hearings in Washington to learn the requirement for titanium and steps being taken to increase capacity.



Fairchild Jet Transport Design

Artist's conception of the Fairchild M-186B 44-passenger transport design shown recently to representatives of 12 U. S. airlines (Aviation Week Nov. 23, p. 20). Major feature of the M-186B is its "cusp" wing, stated to be a delta modified by adding slightly swept extensions. The result is a planform closely resembling the British "scimitar" wing configuration. M-186B is planned around a pair of buried Wright J67 split-compressor jets with a minimum thrust rating of 12,000 lb. each, which would provide a calculated 570-mph. cruise speed at an altitude of 46,000 ft.

Belgians Market New Drug for Airsickness

Efforts are being made to interest U. S. air carriers in use of a new drug for relief of airsick passengers.

Main feature attributed to the product is its prolonged effectiveness, according to the Medical and Pharmaceutical Information Bureau of New York, which announced the drug for its American distributor, Pfizer Laboratories of Brooklyn. Sponsors say a single dose gives 24-hr. protection, where other similar drugs require more frequent administration.

Called Bonamine, the drug was developed by a Belgian chemical firm and is being used by Sabena, Belgian Air Lines, the bureau reports. Tests have been made by U. S. Air Force, Army and Navy doctors and the Belgian air force.

Drowsiness and other side effects are said to be slight.

HOURS ARE PARED from transcontinental flight schedules by AA's New Douglas DC-7.

DC-7 Speeds Up AA Schedules

American Airlines began slicing hours from its transcontinental schedules this week with the inauguration of nonstop DC-7 service between New York and Los Angeles. American will operate one nonstop trip daily on its "Mercury" schedule until Dec. 20, when the second nonstop schedule will be added.

DC-7 schedules call for 7 hr. 15 min. for the eastbound flights, and 7 hr. 55 min. for the westbound trips. As a result of the Civil Aeronautics Administration's certification tests plus preview transcontinental nonstop flights made last week with full passenger loads, there is little doubt among industry observers that the new Douglas transports can make these schedules with ease.

Two preview flights logged eastbound crossings of 6 hr. 38 min. and 6 hr. 31 min., the latter setting a new unofficial transcontinental record for a transport with full load. Average groundspeed of the faster flight over the 2,474-mi. Great Circle course between Los Angeles and New York was 380 mph.

Speed is the primary selling point of the DC-7. American plans to use this speed by offering the fastest transcontinental schedules not only nonstop but also serving Boston, Philadelphia, Washington, Chicago and Dallas.

► **25 on Order**—The airline has 25 DC-7s on order in both the long- and medium-range versions. With delivery of six medium-range transports scheduled in January plus six long-range DC-7s, AA will be throwing the advantage of speed into the highly competitive transcontinental routes by 1954.

"American Airlines is never used to seeing the tails of other transports in the air," AA chief engineer Dan Beard told AVIATION WEEK. "With the DC-7, our transcontinental service will be from 20 to 25 mph. faster than our closest competitor. The DC-7 is the most economical transport in history from the viewpoint of the airlines, with a break-even point of 53% load factor on the medium-range plane and an even lower point on nonstop service."

► **Increased Speed Seen**—There are prospects of increasing the current 365-mph. cruising speed of the DC-7 in the near future.

AA now gets 3,250 hp. from each of the Wright R3350 Turbo Compound engines on takeoff and 1,800 hp. cruising. AA plans to increase the takeoff to 3,500 hp. and the cruising horsepower to 1,900.

American DC-7s use the improved version of the Turbo Compound, with heavy protective shielding around the turbine wheels. Little service trouble has been reported. The four Turbo Compounds of the DC-7 burn 2,900 lb. of 115 octane fuel per hr.

Route Record

National Airlines' first Douglas DC-7 set an official trancontinental speed record for transports on its inaugural flight Nov. 21, crossing the U. S. from Santa Monica, Calif., to Miami, Fla., in 5 hr. 50 min. 12 sec.

The NAL flight, timed by National Aeronautic Assn., clipped nearly 34 min. off the previous commercial aircraft mark of 6 hr. 24 min. set by an Eastern Air Lines Constellation six years ago.

Capt. L. J. Royall reports the DC-7 reached maximum speeds of 450 mph.

The new National transport is scheduled to go into service on the New York-Miami route Dec. 15.

► **Improved Operation**—Observers on preview flights noted the following points of the DC-7's operations:

• **Cabin comfort** is improved over the DC-6. Noise level is about the same despite the increase of 2,400 hp. during the cruising flight and 3,000 hp. during takeoff. Four-blade Hamilton Standard props with slower tip speeds help cut the noise.

• **Douglas beefed** the fuselage in the plane of the propellers by doubling the quantity of steel fuselage rings, using heavier skin and extra Permacel soundproofing. Externally, the DC-7 is much quieter than other types. Turbine blades smooth out normal engine beat and exhaust noise. Props also are quieter.

• **Cabin seats are more comfortable,** particularly the special foam rubber head rest that supports head properly when dozing. Cabin pressurization can maintain 8,000-ft. conditions while cruising at 25,000 ft. Normal DC-7 flight pattern calls for cruising at 20-25,000-ft. altitudes.

• **Freon air conditioning** works well and is particularly noticeable on the ground when outside temperatures are too warm.

► **Indoctrination Problem**—American faces a passenger-indoctrination problem on the spectacle of Turbo Compound exhausts during night flights and torching engines during prop reversal landing runs.

Turbo Compounds have extremely short exhaust stacks to avoid building up back pressure that would result in overheating the turbines. On takeoff, a thick blue flame extends a yard behind the exhaust port onto the leading edge wing. It narrows during the climb and is no problem during the cruise.

Cabin attendants are being briefed to inform passengers regarding "exhaust illumination." During prop reversal, engines torch briefly as airflow decreases and the mixture richens, disquieting passengers in the forward seats. Aft portion of the engine nacelles, strips of the leading edge and top wing skin behind nacelles are made of titanium, providing better heat resistance and saving 200 lb. weight per nacelle. Turbo exhaust is no safety problem.

Other technical points:

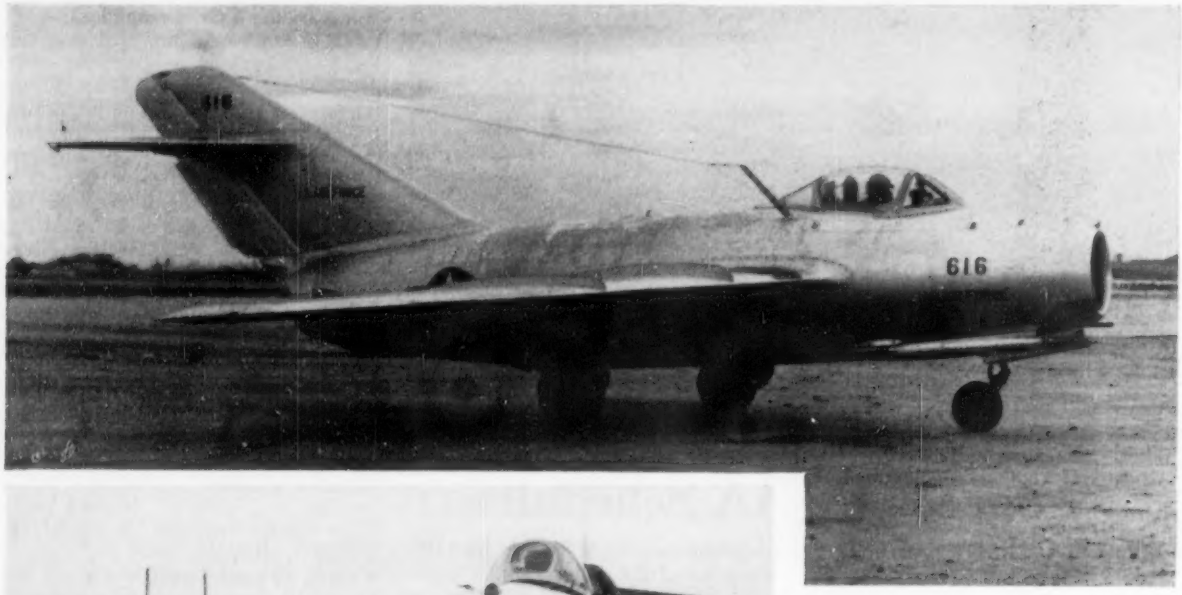
• **The main landing gear** is strengthened for use as speed brakes—similar to the devices on jet fighters.

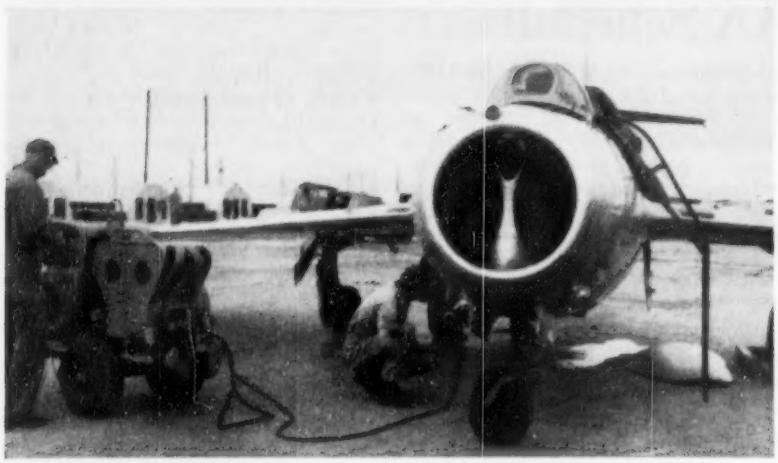
• **Cockpit control** of air brakes drops the main gear by gravity and the airstream holds it in place.

• **Nose wheel** is lowered later by a hydraulic gear control that also locks the main gear for landing.

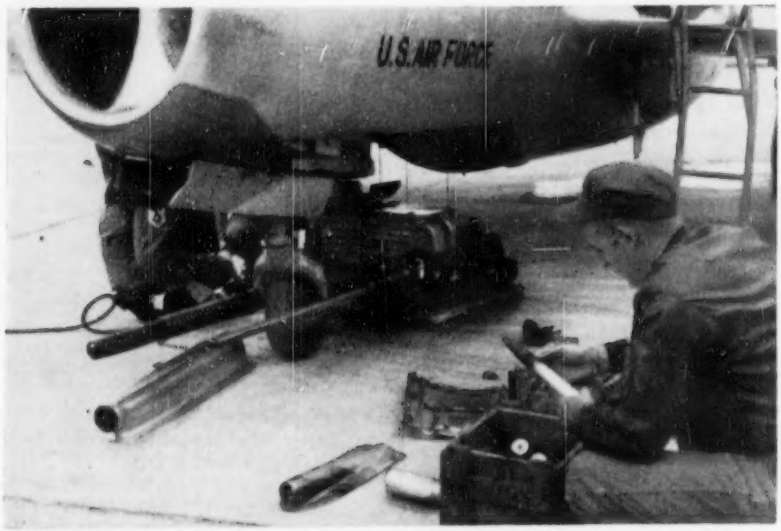
• **Main gear can be extended** at an indicated speed of 300 mph. Pilots on the preview flights were pleased with the aerodynamic trim tab-actuated controls that eliminate the booster system and save considerable weight.

First Detailed Photographs of Russia's Top Operational Combat Aircraft Reveal . . .





MIG BEFORE TAKEOFF shows characteristic chunky lines, broken by bulges for guns and ejection chutes. Pins protruding from wing between fences and ahead of cockpit are visual landing-gear indicators. At left of windshield is shielded pitot.



MIG ARMAMENT pack lowers from fuselage on four cables for access. Fairings on ground cover exposed barrels. Larger cannon (37-mm.) mounts recoil spring and blast tube externally. Panel under nose probably is steel, protects against gunblast.

Red MiG-15:

By David A. Anderton

First detailed pictures of the $100,000 MiG, only Russian-built jet aircraft to come into U. S. hands in flyable condition, have been released by Air Force.

A team of five top USAF test pilots evaluated the Red interceptor against the North American F-86 Sabre in a series of flight tests which covered the range from round-the-field flights to simulated combat. Results of the tests still are being studied; but here are the first pilot reports:

- **The Sabre was preferred** over the MiG as a combat weapon.
- **Lack of automaticity** on the MiG kept the pilot busy and diverted his attention from alert flying.
- **The MiG is slower** in flat-out level flight.
- **Stall warning** is insufficient in the MiG.
- **The MiG cockpit** is uncomfortable and on the small side.
- **Heating and ventilating** systems are poor.

▶ **MiG History**—This particular fighter had been built in 1951 and was the same model used in combat in Korea.

Ro Kum Suk, senior lieutenant, North Korean air force, flew the Russian-built craft to Kimpo Air Base on Sept. 21; the following day the swept-wing interceptor was on its way to

Smooth Finish, Lightweight Construction With Only Four Major Fuselage Bulkheads.

MIG NOSE uses waste space in duct splitter for landing light. Gun camera mounts over cowl inlet; cowl panel for access lies on ground under left wingroot. View shows anhedral droop of swept wings, circular fuselage cross-section.

AF Test Pilots Analyze Captive Fighter

Okinawa in the belly of a C-124.

After reassembly on Okinawa, the MiG-15 was ground-tested; it made its first short, low-altitude flight Sept. 28. The five test pilots who put the little Red plane through the wringer included Maj. Gen. Albert Boyd, commander of Wright Air Development Center; Maj. Charles Yeager, first pilot to fly faster than sound, and Capt. Harold E. Collins, recent holder of the world's 15-km. speed record (F-86D, 707 plus mph.).

► **Miscellaneous** – The photographs show the excellent finish of the MiG, reveal it is built in a conventional manner. There apparently are no large pieces of machined skin, for example. Large numbers of rivet lines criss-cross the fuselage and tail surfaces, showing that the structure underneath is composed of many light frames and stringers. Only four major bulkheads are indicated by the rivet pattern.

MiGs which fought in Korea were credited with a top speed of about Mach 0.92. The airplanes grossed about 12,500 lb. without drop tanks. Engine was a Russian development of the Rolls-Royce Nene, rated at under 7,000 lb. thrust with water injection; Russian designation of the engine is VK-1.

Wingspan of the sweptback craft is 33 ft.; overall length is about 35 ft.

MIG TAIL has large blister at juncture of horizontal and vertical surfaces to prevent flow breakaway. Elevator has external skin doubler near outboard hinge. Top rudder hinges are external; lower are hidden. Dark patch is speed brake.

F4D Trials

- **Pilot describes Skyray tests aboard Coral Sea.**
- **Navy's fastest jet passes check in rough weather.**

El Segundo, Calif—Qualification of the Douglas F4D Skyray aboard the aircraft carrier Coral Sea was a "routine" operation for the Navy's fastest jet fighter, first carrier-based plane to hold the world's speed record, Lt. Cmdr. James B. Verdin reports (also see p. 9).

Verdin, who flew the Skyray to its record 753.4 mph. (AVIATION WEEK Oct. 12, p. 16), was one of two Navy pilots who put the XF4D-1 through its paces during carrier qualification tests Oct. 26-30 in the Atlantic off Norfolk, Va. The other was Cmdr. Marshall Beebe, director of the Flight Test Division of the Navy's Patuxent River, Md., test center.

"The weather was windy with intermittent squalls," Verdin said. "The deck was pitching considerably but this gave a good check on the airplane's capabilities for carrier operations."

▶ **Lowspeed Stability**—In an interview with AVIATION WEEK, he described the Skyray carrier qualification in detail.

Among tests conducted were minimum speed trials off the catapult and for landing approach. The Navy record-holder said the F4D was "comparable with other carrier aircraft" in this respect.

"It handled at least as well off the catapult as any other jet and better than some," Verdin said. "It is a very stable and steady aircraft at low speeds."

The F4D's Westinghouse J40 engine without afterburner performed "very well" during the carrier trials, the Navy pilot said. "Outside of a little bit of fuel control trouble, which was only a matter of adjustment, its performance was excellent."

▶ **No Bobbles**—Tests were conducted to determine the most practical approach speed for the Skyray and to test the waveoff characteristics at various speeds. Deck handling characteristics under varying wind conditions, ease of catapult launching, handling off and on the carrier elevators were checked.

"It was fine in all respects as far as I could tell, although the report undoubtedly will show some things have to be changed," Verdin stated. "They were able to get the plane around the deck without trouble. There were no bobbles in getting on the catapult. It went right on every time."

▶ **Typical Tests**—Approximately 30 landings and catapult takeoffs were made with F4D aboard the Coral Sea, according to Verdin. Describing a typical flight test, the Navy pilot said:

"After the plane is hooked up aboard the catapult, you go over the checkoff list. When ready to go, you give the catapult officer the thumbs-up sign. He holds up two fingers to indicate that he is ready. You run up the power, check your instruments, put your head back on the rest and give him a salute. Then you're fired. It's quite a jolt."

The explosive charge slams the F4D out of its grooved slot with sufficient force to bring it up to flight speed in a distance of approximately 50 ft.

▶ **150-Ft. Landing**—After putting the Skyray through fuel-consuming high-performance acrobatics to bring it down to landing weight in a hurry, the test pilot made his landing approach.

"You come down the starboard side, drop wheels, drop hook, go over your checkoff list and turn downwind. You judge your altitude by putting the stack of the carrier on the horizon. You get abeam of the ship, turn into it. By then your speed is within a few knots of where you want it for landing.

"About 45 deg. from the ship, you can see the signal officer. Coming in, you answer his signals, then when he gives you the cut, you pull the throttle and land."

The highspeed F4D lands slow enough to stop in the space of 150 ft. on the carrier deck with an assist from the arresting wires, Verdin said.

Aircraft Firms Fight New California Tax

Aircraft industry and the Defense Department are planning court tests of the legality of a 6% personal property tax which four California counties have assessed manufacturers in their respective counties.

Following the lead of Los Angeles County, San Diego, Alameda and Riverside County assessors have taxed the amount a contractor has in tangible personal property equal to the difference between the total value of the inventory (principally machine tools, parts and materials) plus work in process (such as aircraft on the line) and the progress payments received (AVIATION WEEK Oct. 19, p. 12).

Formerly the counties taxed that portion of a manufacturer's military contract not yet paid by the government under the progress payment plan as an account receivable or solvent credit at a rate of ⅓ of 1%.

▶ **First Attempt**—Los Angeles County is the first to attempt this type of tax in the U. S. It stands to gain about $12 million a year from the new tax.

Such an increase in the tax on a government contract would be deducted from the total contract value. This would cut down the number of aircraft, in the case of airframe manufacturers, which could be produced under a contract.

Government attorneys have been working on the problem since Los Angeles County Board of Equalization denied in August the petition of 60 county aircraft manufacturers to reduce the tax. Included were major aircraft firms such as Douglas Aircraft, Convair-Pomona, Lockheed, Northrop, North American and Hughes, in addition to smaller prime and subcontractors.

The board denied all petitions after month-long hearings.

▶ **Committee Organized**—A steering committee has been organized by Defense Department's general counsel, H. Struve Hensel, and the group has had one two-day meeting at the Pentagon to determine how to attack the measure legally. Aircraft industry and Atomic Energy Commission representatives were present.

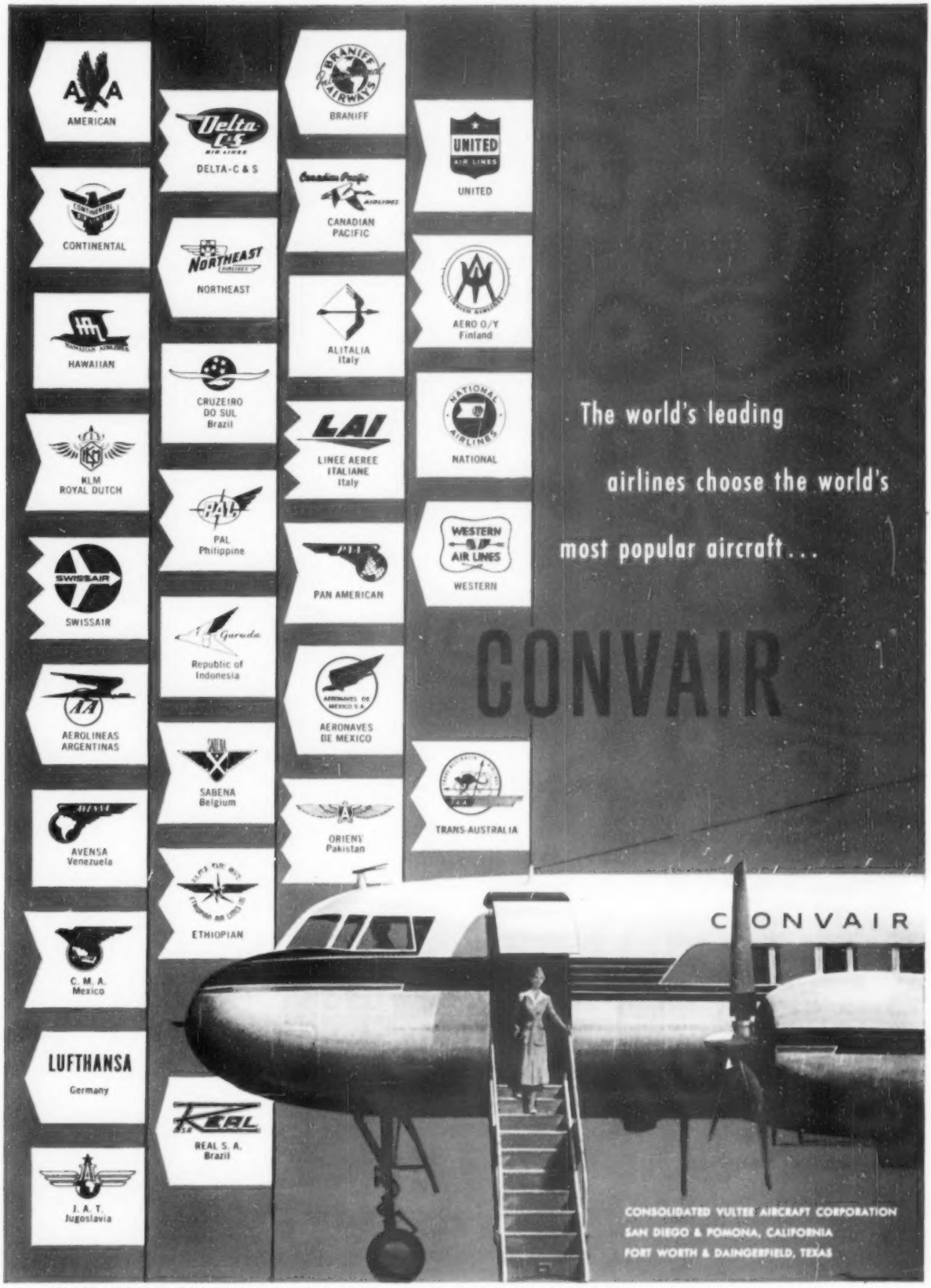
The committee now awaits additional information from the contractors involved and advice from the Justice Department before it makes the next move. Test cases will be selected carefully by the committee and court action probably will begin in Los Angeles County Superior Court or federal court.

If necessary, the government plans to take its fight to the U. S. Supreme Court. The method of attack probably will be decided before Dec. 10, the date on which the new tax becomes delinquent for manufacturers on Los Angeles County secured tax rolls.

▶ **Chairman Named**—Chairman of the steering committee is Jack L. Stempler, assistant general counsel, supply and logistics, for the Defense Department. Other members appointed by counsel Hensel and the three service secretaries: Meritt H. Steger, assistant general counsel for Navy; Cmdr. Walter J. Fitzgerald, Navy Judge Advocate General's office; Gerritt W. Wesselink, associate general counsel for procurement, USAF; Lt. Col. Robert H. Hunter, USAF Judge Advocate General's office; Brig. Gen. Claude B. Mickelwait, and Lt. Col. Russell N. Fairbanks, both of the Army Judge Advocate General's office.

The steering committee takes the stand that the tax is not only illegal but unconstitutional since it is a tax on government property. Bills have come up before Congress in the past proposing various taxes on government property but none has passed.

▶ **Douglas Wins Case**—During World War II, the Los Angeles County tax assessor tried such a personal property tax in order to obtain more funds to run the county. Douglas Aircraft took the case to court and received a favorable decision from the Intermediate Court of Appeals.



AS A TRANSPORT-TRAINER FOR THE U.S. AIR FORCE, THE CONVAIR IS SETTING NEW RECORDS FOR VERSATILITY AND PERFORMANCE . . . ANOTHER EVIDENCE OF CONVAIR'S ENGINEERING TO THE Nth POWER

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Larger extrusions—thinner and more intricate than ever before—can be produced on this giant 14,000-ton press by Alcoa. For example, ribbed panels 36 inches wide can be extruded and flattened, saving greatly in riveting and assembly.

It increases maximum extrusion size from a 15-inch to a 23-inch circumscribing circle —or from 600 pounds to 2,300 pounds per piece! This press is another step in Alcoa's "big press" program giving better service to America's aircraft industry.

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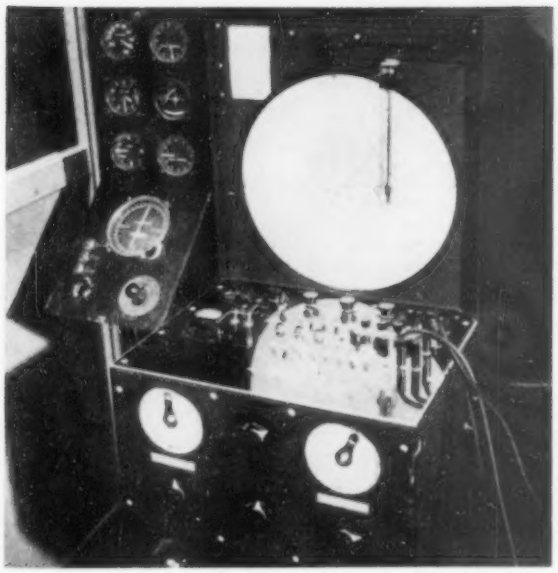
Alcoa brings the world to your armchair with "SEE IT NOW" featuring Edward R. Murrow. Tuesday evenings on most CBS-TV stations.



DEHMEL automatic radio aids unit is core of Flight Safety's pilot training program, flashing simulated problems for any airport to . . .

LINK cockpit, where trainee is called upon to fly ranges and practice approaches and holding procedures. Dehmel records actions.

CLASSES, like one shown above, are held between instructor and pilot-co-pilot team. Training program is closely supervised by . . .

PRESIDENT Al Ueltschi, Flight Safety founder and veteran transport pilot with a million-mile safety record as business pilot.

Business Flying

Refresher Pilot Training Pays Off in Safety

By Frank Shea, Jr.

A private venture in flight safety, in the form of a refresher training program for business pilots, is paying off big dividends in higher operating standards for executive aircraft flying.

Sponsor of the program is Flight Safety, Inc., operating out of the former international terminal at New York's LaGuardia Airport. Privately operated Flight Safety, Inc., (not to be confused with nonprofit Flight Safety Foundation, Inc.) boasts one of the finest pieces of electronic pilot-training equipment in the business, a Curtiss-Wright Dehmel automatic radio range. Only five U. S. airlines possess comparable equipment.

With the Dehmel and a hand-picked staff of instructors, the organization is able to offer comprehensive courses that have gained the confidence of more than 300 pilots from some 47 business firms who have attended classes.

▶**Top Notch Pilots**—Al Ueltschi, veteran transport pilot who has also racked up a million miles of safe flying as a business pilot, is president of the organization. Ueltschi is executive pilot for the president of a major U. S. air carrier.

"Business pilots are top notch," says Ueltschi. "A look at the safety record proves it. . . . The figures speak for themselves.

"But these fellows want to remain top notch. This means maintaining their proficiency and keeping up to date on latest operational procedures.

"Airline pilots are required by law to take periodic refresher training. Business pilots should at least be given the

Tracking flight path of early Boeing guided missile.

On its way—a supersonic missile of defense

Boeing's F-99 Bomarc is an aerial destroyer, designed to strike enemy bombers attempting to attack the continental United States. It is a logical outgrowth of Boeing's extensive earlier developmental work in the guided missile field.

The F-99's rocket engine hurtles it from the ground to its operating altitudes, and to speeds beyond those of sound. During test flights the unmanned F-99 broadcasts to earth a complete record of what's happening. This data, recorded on tape and processed through electronic computing machines, furnishes information about speed, temperature changes, fuel consumption and countless other factors vital to continued progress in this complex field.

Bomarc is designed to carry out its mission under the guidance of radar and other electronic equipment. These ingenious devices control the F-99's flight path and guide the missile into position to destroy the target aircraft.

Boeing's pilotless interceptor experience is not confined to work on the Bomarc project. Its earlier program, also sponsored by the Air Force and known as GAPA, produced rocket missiles that attained speeds in excess of 1,500 miles an hour. Today Boeing is devoting a substantial amount of its engineering effort to developing complete systems of air defense.

Guided missiles, along with strategic jet bombers, are a strong deterrent against attack. In each of these fields, Boeing's contributions are characterized by unyielding integrity of design and construction—and by the sound, imaginative kind of research that produced the revolutionary B-47 Stratojet and the eight-jet B-52 Stratofortress. These advanced aircraft, in common with the F-99, bear a name you can depend upon: Boeing.

Boeing is now building a prototype jet transport, designed to be adaptable for either military or commercial use. The new plane has the benefit of Boeing's unparalleled experience in multi-jet aircraft. It will fly in 1954.

BOEING

same opportunity to stay on top of their jobs."

► **Progressive Thinking**—Pilot enthusiasm for the program would seem to bear him out. Equally enthusiastic are the executives that these men fly. Ueltschi says their foresight and progressive thinking have made Flight Safety a success, noting that "without their cooperation we never would have gotten off the ground."

In its sales campaign, however, Flight Safety doesn't go directly to the executive. First, they work on selling the pilot. Once he's sold, they team up together to sell the company.

Ueltschi reports some pilots were hesitant at first, thinking it might be some sort of elimination program. But once convinced it was not, they were quick to sign up.

Flight Safety instructors don't grade or rate their "students" in any way, nor can they be coerced into giving comparisons on pilots—one company's against the other's.

► **Exacting Job**—"These boys are good," says Ueltschi, "or else they wouldn't be holding the jobs they have. We feel that, in many respects, the job of the business pilot is more exacting than that of any other pilot in the profession. He must be prepared to fly anywhere, at any time, frequently over unfamiliar routes and into airports with primitive facilities."

He points out that the business pilot serves as his own dispatcher and meteorologist, and occasionally as his own mechanic.

"He must resist any pressure, direct or implied, to compromise safety," Ueltschi says. "And his standards must be the highest—he flies men who are among the most important and valuable in the nation."

Ground Training

Flight Safety trainees receive a series of courses. The first is the longest, lasting about seven days. Then, if pilots and corporation executives agree that it is worthwhile, refresher training is given at six-month intervals. Each refresher period lasts about three or four days.

Start of the initial course is a set of uniform standards for operation of business aircraft. These can be applied to operation of one plane or an entire fleet.

► **Performance Analysis**—Then, getting down to specific crew problems, Flight Safety compiles an up-to-date manual for the type aircraft a particular crew is flying.

Information for this manual is not taken from manufacturer's handbooks. Each aircraft is test flown and put through its paces. At the end of the course pilots know just what they can expect from their airplanes. Their knowledge is based on experience, not figures in a handbook.

Aircraft performance analysis includes: performance limitations at takeoff; best power settings for takeoff, climb, cruising and high speed, maximum endurance and maximum range cruise; single-engine performance; V1 and V2 speeds and fuel consumption.

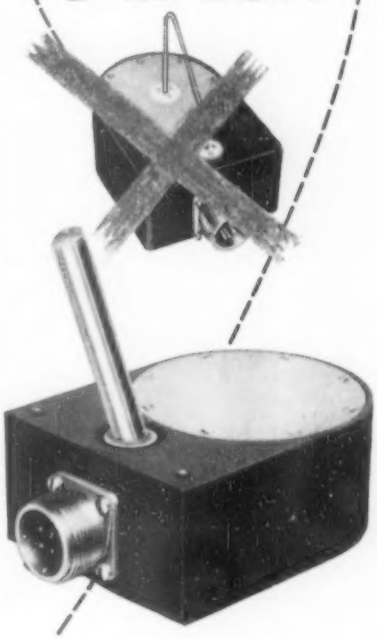
► **Biggest Asset**—Meteorology gets a big play in the Flight Safety program. Covered are such subjects as how to get maximum information available, weather situations that cause the most trouble, flight planning with respect to winds and weather plus any general recent developments in the field.

Biggest asset in the program is the Dehmel automatic radio range. Integration of this unit with a link trainer

McDonnell Delivers Final Banshee

Last of more than 800 Banshee twin-jet carrier fighters was delivered to Navy by McDonnell Aircraft Corp., St. Louis, Mo., Oct. 30. The last Banshee, an F2H-4 all-weather model, is seen at the ceremony, attended by the company's president J. S. McDonnell (third from left) and Comdr. C. H. S. Murphy, BuAer representative.

We removed the
HAIRPIN
and installed a
STACK



Because the Ice Detector probe required a more rugged structure for installation handling and contemplated operating conditions. We also gained a 35% weight reduction, a greatly expanded operating range, selective sensitivity, eliminated A.C. power requirements and obtained complete reliability. Again proving that product improvement will result from continuous Research and Testing. The Diaphlex Ice Detector will automatically sense icing conditions in accordance with MIL D 8181. Ideal for Jet Engine intakes and Aircraft airfoil surfaces.

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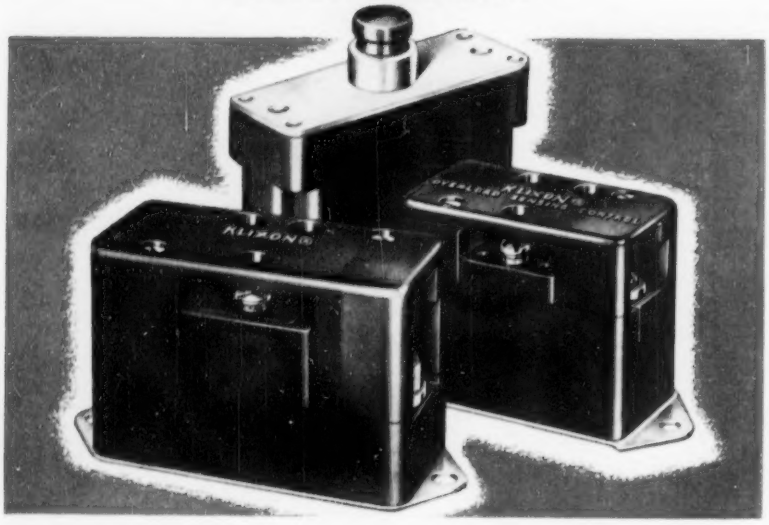
PROTECTION PERFORMANCE Assured

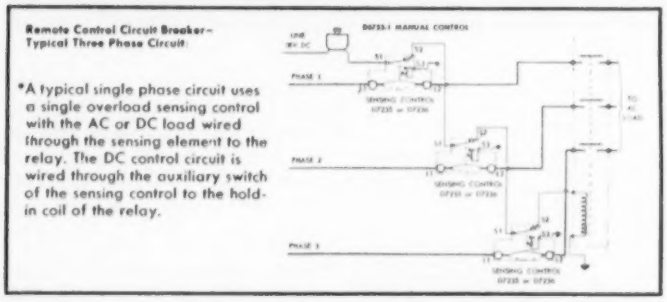
NEW

KLIXON OVERLOAD

Sensing Controls and Remote Control Circuit Breaker



Remote Control Circuit Breaker — Typical Three Phase Circuit


Remote Control Circuit Breaker—
Typical Three Phase Circuit
*A typical single phase circuit uses a single overload sensing control with the AC or DC load wired through the sensing element to the relay. The DC control circuit is wired through the auxiliary switch of the sensing control to the hold-in coil of the relay.
D6753-1 MANUAL CONTROL
PHASE 1
PHASE 2
PHASE 3

These new Klixon Overload Sensing Controls (D7235 and D7236) and Klixon Circuit Breaker (D6753) are designed for remote sensing and indicating of overloads in aircraft systems.

The D6753-1 Manual Control and the D7235 or D7236 Overload Sensing Controls plus a relay contactor make up the entire system. Depending on the characteristics and the capabilities of the relay used, this combination is suitable for protection of A.C. and D.C. circuits of any voltage, and in A.C. circuits operating at any frequency. However, the Manual Control is presently designed for a 28 Volt D.C. control circuit.

The D7235 and D7236 Overload Sensing Controls are completely sealed, and the D6753-1 Manual Control sufficiently sealed to make all units explosion-proof and resistant to corrosion.

Like all Klixon Circuit Breakers they are individually calibrated and inspected for Ultimate Trip and 200% load tripping characteristics, and have very high shock and vibration resistance.

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enables pilots to practice simulated ILS, VOR, VAR and RMI procedures.

Automatically reproducing almost all range signals, the unit is able to simulate approach traffic patterns for any major U. S. airport. In this way pilots are able to practice approaches and holding procedures for different high density airports. The Dehmel records their every movement and tells them where they made mistakes.

Flight Training

Flight training encourages pilots to reveal their weak points so that these may be stressed during the course.

Each company furnishes its own plane for the training. Pilot and co-pilot occupy their regular positions, and a Flight Safety instructor is in the jump seat. Aircraft need not be taken out of company service for a consecutive number of days, however. Flight Safety's courses can be staggered so as not to interrupt normal flying schedules.

▶ **Preflight to Airwork**—First part of training is devoted to preflight procedures, covering such functions as visual inspection, use of check lists, setting up radio equipment, engine starting procedures, taxiing and engine runup.

Various takeoff conditions are simulated. Pilots might try one with a simulated engine failure. This could be followed by a crosswind takeoff, while others would be made under conditions of low ceiling and limited visibility. Each procedure is repeated until the pilot feels he is up to peak flight performance.

Airwork covers such maneuvers as climbing turns, maximum performance climb, steep turns, recovery from unusual altitudes and rapid descent and pullout.

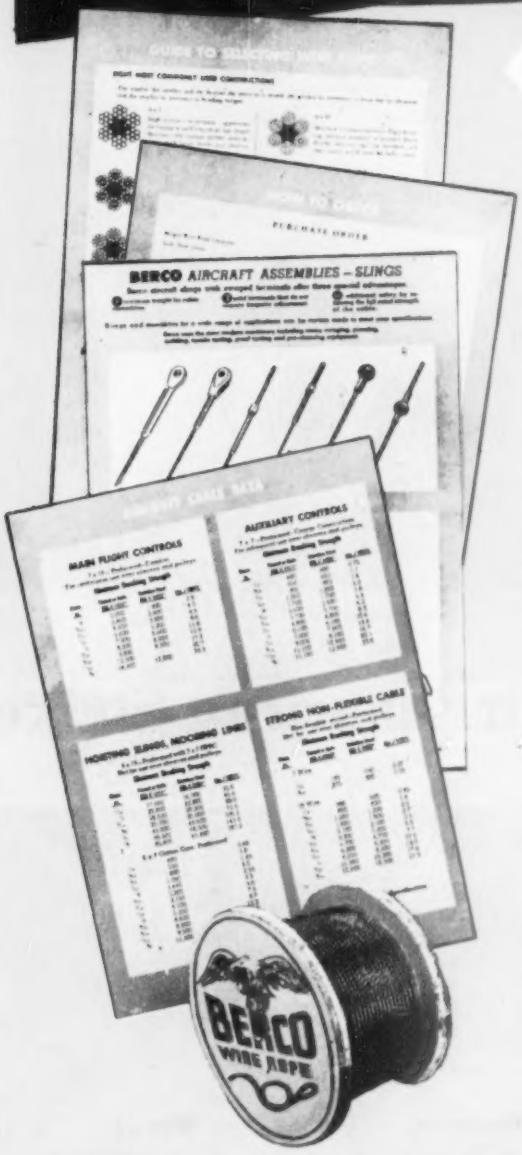
▶ **Continuous Refresher**—Instrument navigation training includes radio equipment familiarization, DF orientation, ADF tracking, ILS bracketing and approaches, VOR navigation and letdowns. Departure procedures for New York and other heavy traffic areas are stressed.

Emergency procedures come in for a lot of attention. Engine, heater and cargo compartment fires are simulated. Items such as feathering and unfeathering, smoke removal, hydraulic pressure failure, fuel dumping and use of oxygen equipment are given heavy coverage.

Landings are a major consideration. Practice runs are made with one engine out, bucking a cross wind or under simulated weather minimums. Zero flap, emergency brake operation and refused landings also are covered.

Ueltschi sums up the Flight Safety program this way: "Continuous refresher training to keep an already proficient pilot up to his top performance."

LONGER SERVICE-LOWER COSTS FOR YOUR AIRCRAFT CABLES!



BERCO'S "GUIDE TO SELECTING WIRE ROPE" WILL HELP YOU SPECIFY THE MOST ECONOMICAL CABLE FOR EVERY NEED.

For every service requirement there is one particular cable that will do the work better—last longer—cost less than any other. That cable is designed to offer the right amount of resistance to bending, impact, heat, corrosion. It is strong enough to be safe under its required operating conditions, yet it is light in weight.

Berco's "Guide to Selecting Wire Rope" is designed to help you specify the best cable for every service. It explains clearly and concisely the critical factors in cable design, and contains easy-to-use tables giving breaking strengths, weight per 100 ft. and other data for the most commonly used aircraft cables, hoisting slings and mooring lines. Send for a copy today together with Berco's handy "Wire Rope Data Sheet" for writing specifications.

Return the coupon *today.*

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BERCO WIRE ROPE

Gentlemen.

Kindly send me a copy of your brochure "Guide to Selecting Wire Rope."

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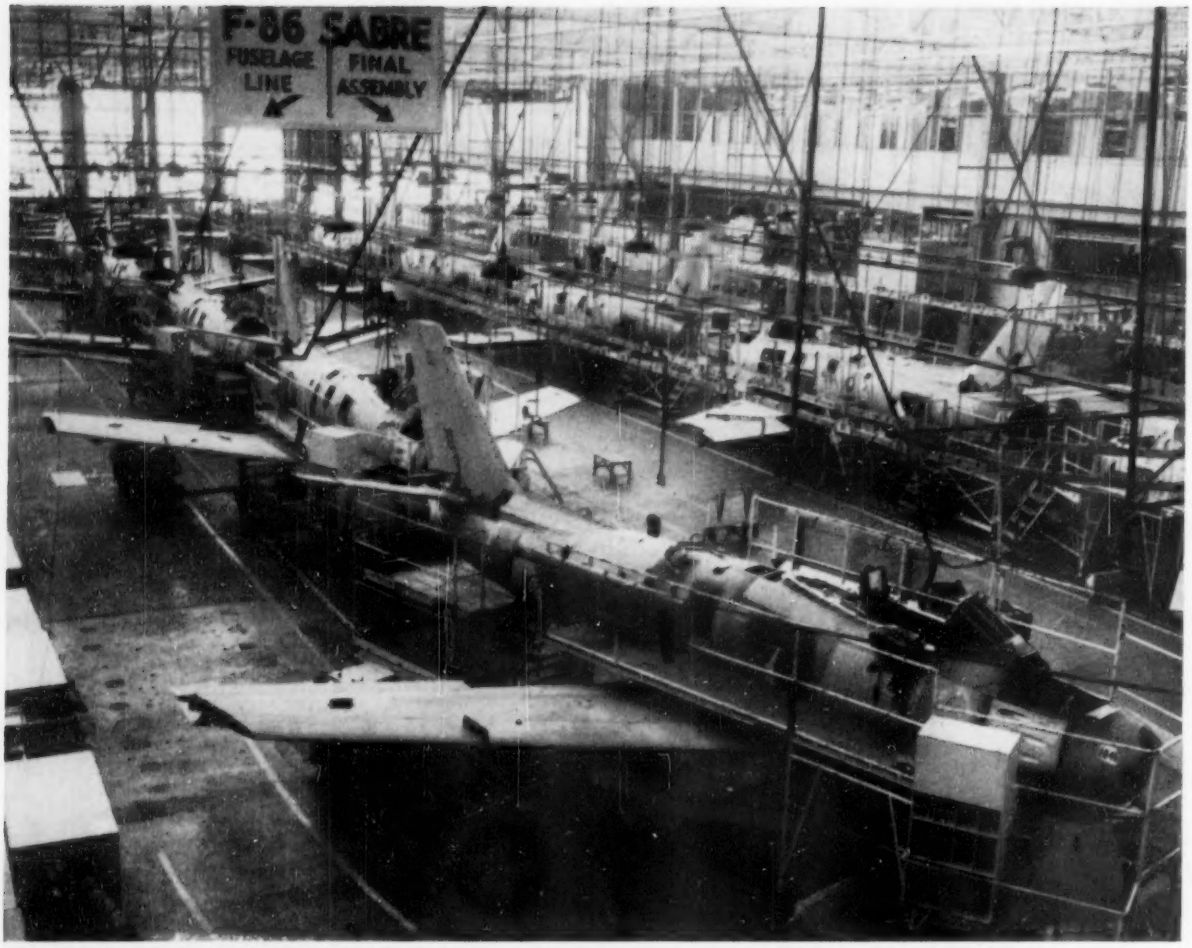
BERGEN WIRE ROPE COMPANY



DESERTED F-86F ASSEMBLY LINE at North American Aviation, Inglewood, Calif., after strike started Oct. 23.

Picture Study of North American Strike

SUPERVISORY PERSONNEL took over. This is electrical and radio section.

ENGINEERING DEPARTMENT on the job during the strike, typical of 15,000 professional-clerical employes who remained in the plant after 19,000 workers went out.

ONLY A TRICKLE of workers, compared to customary heavy traffic, passes out the gates at 4:30 shift change under eyes of orderly pickets that encircled plant.

SUPPLIES COME THROUGH without interference but jam warehouses.

FEDERAL MEDIATOR John Fenton tries to keep negotiations going smoothly.

UNION AND NORTH AMERICAN NEGOTIATORS swap arguments at swank Miramar Hotel in Santa Monica. Union asked 26 cents-an-hour wage increase.

NEGOTIATOR for striking UAW-CIO workers at NAA listens intently as North American representative gets in a point.

NEGOTIATOR for North American looks weary as talks drag on. Strike of 33,453 idled three plants in California and Ohio.

Can you see the BIG difference?

On the face of it, Avien's Two-Unit Fuel Gage looks like previous systems, but there's a big and important difference behind it all.

Behind this Avien dial face (shown here three times actual size) is Avien's brand-new concept of fuel gage system "packaging."

Previously, you'd find these units behind a dial: an indicator case, motor and balancing potentiometer; and elsewhere a bridge-amplifier, a shockmount and a tank unit.

Now, in the Avien Two-Unit Gage, the necessary components for the bridge and amplifier functions have been built right into the indicator case.

The result: a fuel gage system of "plug-in, plug-out" simplicity, which weighs 50% less and eliminates the need for any field calibration.

What a BIG difference this makes in money!

First of all, the basic system costs less. Less time is spent in installation. Less wiring and connectors are needed. Less maintenance is required, because there are fewer components to maintain. Trouble-shooting time is cut for the same reason. And fewer parts must be stocked for maintenance and repairs.

Because of this new package, Avien gages are now "shelf items." They're completely interchangeable in the aircraft for which they are designed.

Additional functions for fuel management can be easily integrated into the basic Two-Unit system.

The Avien Two-Unit Fuel Gage is now available to meet your production programs. The indicator is available in either large or small sizes, with all varieties of dial configurations.

Every month, Avien produces over ten thousand major instrument components for the aviation industry.

The Avien Two-Unit Fuel Gage will make such a BIG difference in your cost sheet, we suggest that you write or call for more information today.

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NAL Asks No Subsidy For Copter Operation

National Airlines has asked Civil Aeronautics Board for immediate permission to start nonsubsidized helicopter operations in Florida, thus bypassing protracted certificate hearings.

National, with one Sikorsky S-55 and options for two more, is the first airline to go into nonsubsidy copter operation. (AVIATION WEEK Oct. 26, p. 91).

NAL says it wants a temporary CAB exemption to prove that the public will respond to the service in sufficient numbers to make it a success.

Such authority would be similar to CAB's experimental aircoach permits and blanket exemptions to airfreight operators in 1947, National says.

The carrier proposes to try a charter rate of $2 per plane-mile.

The south Florida area that National proposes to serve is "an ideal area for the conduct of an experimental operation of this type," NAL says in its application. The airline cites:

- **Ideal weather.**
- **Terrain** of many bays, inlets in swamps that make copter transportation most desirable because surface transport is circuitous.
- **Vacation market** of "unparalleled volume."
- **Racetrack, airport** and fishing transport requirements suited to shorthaul, high-price copter transport.
- **National** is the only local service carrier operating in the area.

Improved Turboprops Boost Viscount Power

(McGraw-Hill World News)

London—Improved guide vanes and turbine blades of the Vickers Viscount's Rolls-Royce Dart turboprop powerplants are expected to provide the planes with 80-90 additional horsepower at cruising conditions, increasing the transport's speed by approximately 18 mph.

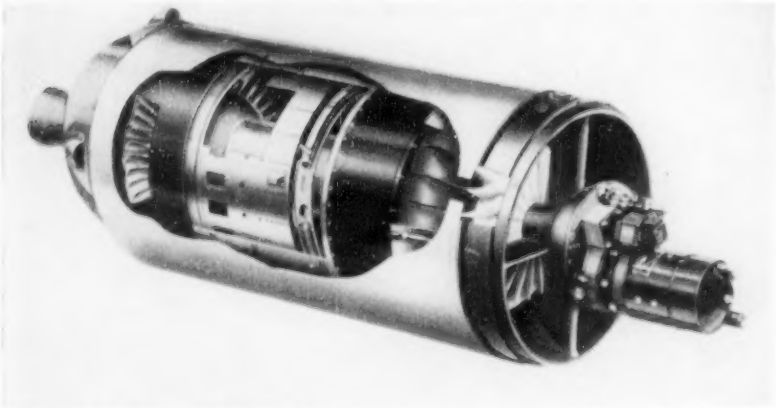
A reduction in specific fuel consumption is also gained, Vickers claims. The new engines are rated at 1,550 shp. on takeoff.

All new Viscounts on order will have the modified powerplants and earlier planes will be fitted with these engines. The additional power eventually will permit operating the Viscount at 60,000 lb. gross takeoff weight, compared with the present limit of 58,500 lb.

Cruise performance figures for the Viscounts with the updated Darts (current performance shown in parenthesis): 331 mph. at 15,000 ft. (314); 329 mph. at 20,000 ft. (311) and 323 mph. at 25,000 ft. (304).

Fairchild Stresses Simplicity in J44 Jet

ONE APPLICATION of Fairchild's J44 is in Ryan's Firebee target drone shown just after release from Douglas B-26 mother plane over New Mexico desert.



J44 CUTAWAY reveals engine's major components surrounded by load-carrying monocoque shell. Details of these parts are identified in the exploded view below.

• Engine's original design was for expendability, but its features would lend it to long-life uses as well

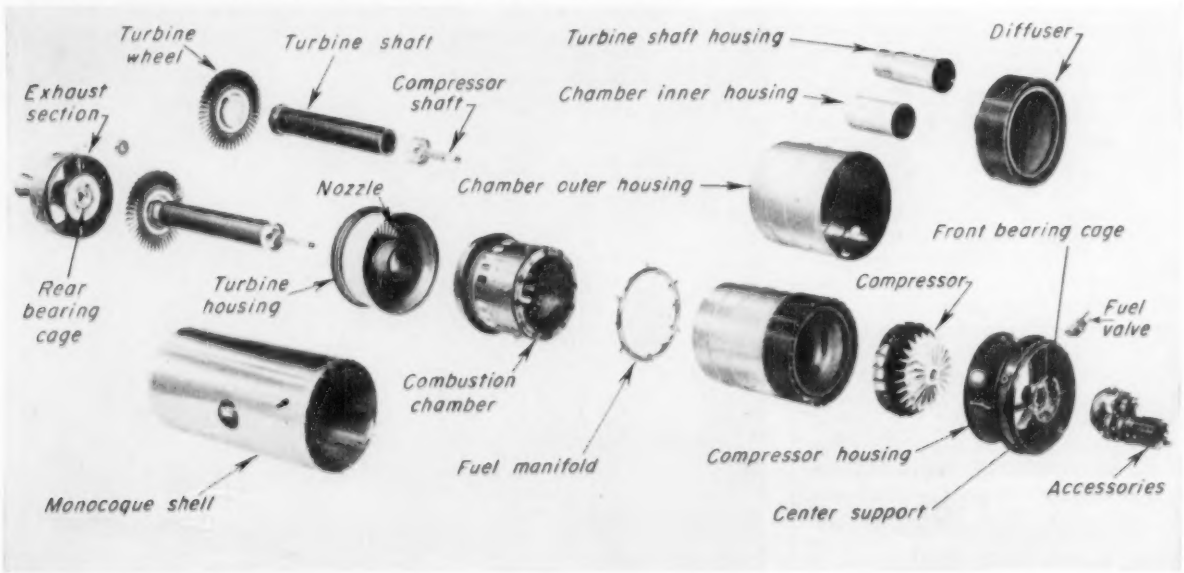
By Irving Stone

The 1,000-lb.-thrust Fairchild J44 is the first U. S. turbojet engine designed from the start for expendability—a jet engine to power target drones and one-shot missiles.

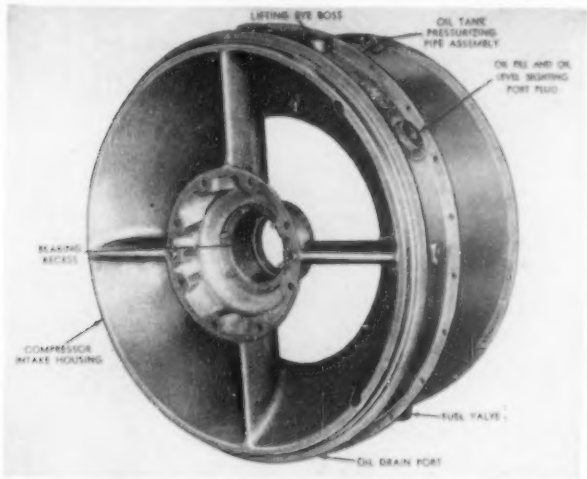
Reduced to a dependable bare structural minimum for the job it must do as a relatively "short-life" engine, the J44 emphasizes simplicity and manufacturing economy. For example:

- **A simple monocoque cowl** carries the engine load.
- **Comparatively few assemblies** are involved in the engine's makeup.
- **Machined parts** are held to a minimum.
- **Fuel nozzles** are of the home oil-burner type, cost only about 80 cents each.

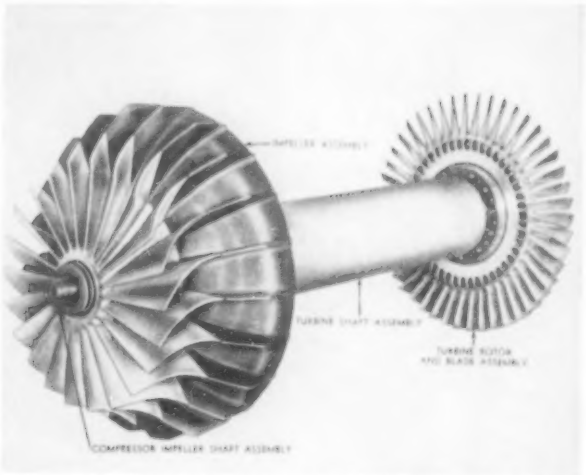
The engine is an ingenious piece of work from design conception to its execution on the production floor. And although designed to be expendable, results achieved indicate that the J44's features are readily applicable to "long-life" jets for piloted vehicles, it is reported. Engine life already has been



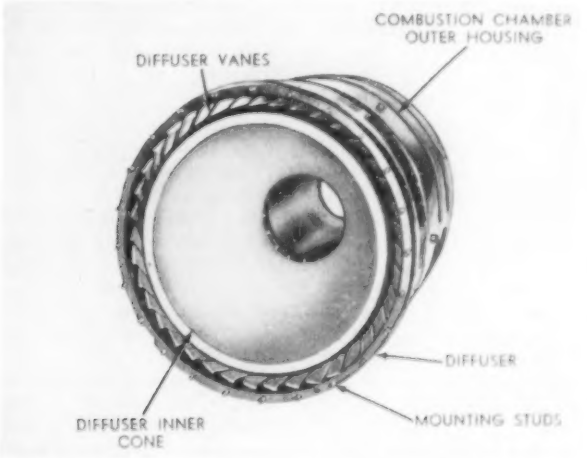
'Compact, Rugged and Highly Producible . . .'



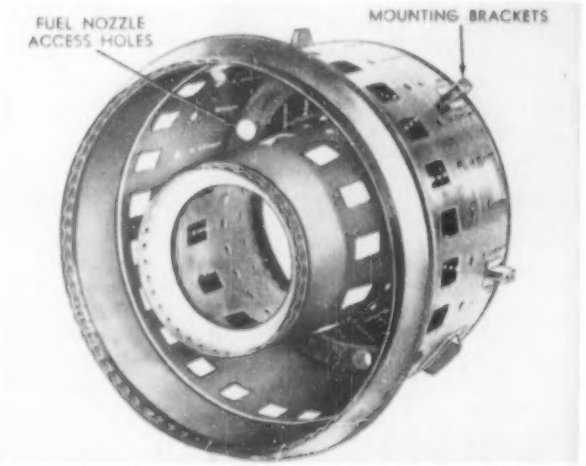
COMPRESSOR HOUSING has bearing cage, mount for the accessories, and integral oil tank ahead of the impeller area.



IMPELLER is hooked to turbine wheel by large-diameter hollow shaft which uses a bolted connection at flanged ends.



DIFFUSER is one-piece magnesium casting containing 39 vanes. Unit is riveted to combustion chamber outer housing.



COMBUSTION CHAMBER viewed from rear clearly shows annular configuration. Dome carries 12 inexpensive nozzles.

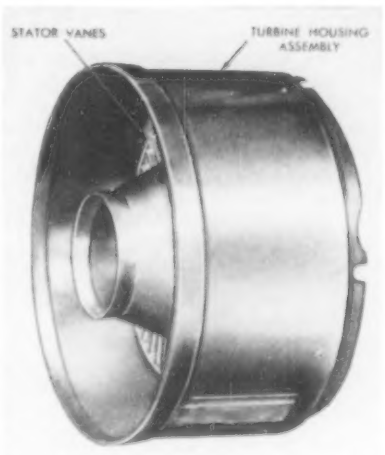
appreciably extended from the original qualification-test time, it is said.

► **Long in Missiles**—Although initially identified by its creator, the Engine Division of Fairchild Engine and Airplane Corp., as a powerplant for Ryan Aeronautical Corp.'s Firebee target drone, the J44 saw missile service long before the Firebee was operated. The engine has been a jet muscle for U. S. guided missiles that have been fired since 1950.

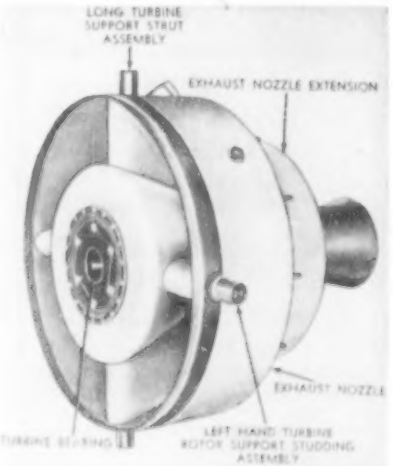
In the Firebee application, where the drone has been recovered by parachute, the recovered engine (Model J44-R-12) has been used repeatedly in flight schedules.

A larger-thrust version of the J44 is now being developed for other specific missile and target drone applications, AVIATION WEEK has learned.

► **Fresh Approach**—Design of the J44 was laid down in 1947. A rigid military requirement of size, weight and thrust



TURBINE HOUSING is welded to cast one-piece nozzle of shrouded stators.



EXHAUST SECTION houses the rear bearing, strut supports for engine shell.

controlled makeup of the powerplant.

The engine was slated for expendable drone and missile applications at a time when drone-recovery rates were expected to be low. For this reason, the engine was put through only a 12½-hr. qualification test. This amount of "built-in" time was considered necessary merely to protect personnel during ground runup and vehicle launching operations.

Even though the engine was considered a short-life design, Fairchild's engineers started from scratch with an open mind for a fresh approach to meet the military requirements, rather than cobbling some existing design for downgrading, designwise and materialwise. The result was a compact, rugged, high-producibility design.

▶ **Five-Section Makeup**—The J44 comprises five main sections—accessory, compressor, combustion, turbine, and the exhaust section.

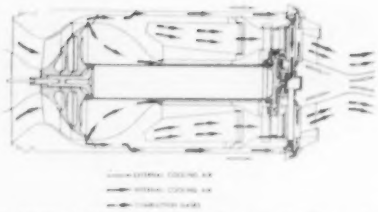
Completely assembled, the engine weighs 303 lb. dry, minus some equipment. Its overall length is only 75.7 in., its diameter is 22 in.

It is a cantilever-mounted installation, secured to the airframe by a clamp on the compressor housing flange. The engine also can be adapted for 3-point mounting, with no trunnions protruding outside the engine's diameter. Center of gravity of the engine is on the centerline of the engine cowl, about 20 inches aft of the mounting flange.

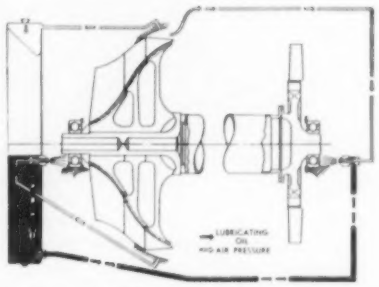
▶ **Accessories**—The accessory section is mounted as a unit on the central portion (front bearing support) of the compressor intake housing's forward end. It is secured to the housing with eight bolts, and is easily removable by one man for replacement as a unit when any of its components requires service.

The accessory section consists of a drive housing-and-gear assembly accommodating an alternator, tachometer generator, fuel pump, fuel filter, governor, ignition coil, and power lever control actuator.

▶ **Mixed-Flow Compressor**—The compressor is a mixed-flow type. It is a centrifugal impeller unit which takes in and discharges the air axially. It eliminates the production disadvantage of the numerous rotor and stator blades involved in the axial-flow type of compressor. Compressor pressure ratio is 2.5 to 1 at rated speed.



COOLING air and gas flow path through J44 is delineated in this sectional view of engine. Centrifugal compressor's air intake and discharge embodies axial flow.

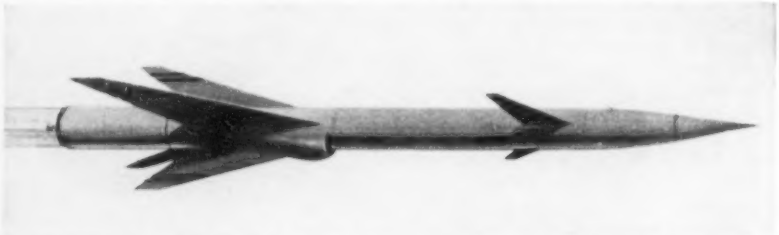


LUBE SYSTEM is simple arrangement. Oil reservoir is integral with compressor housing. Pressurizing air is bled from impeller discharge.

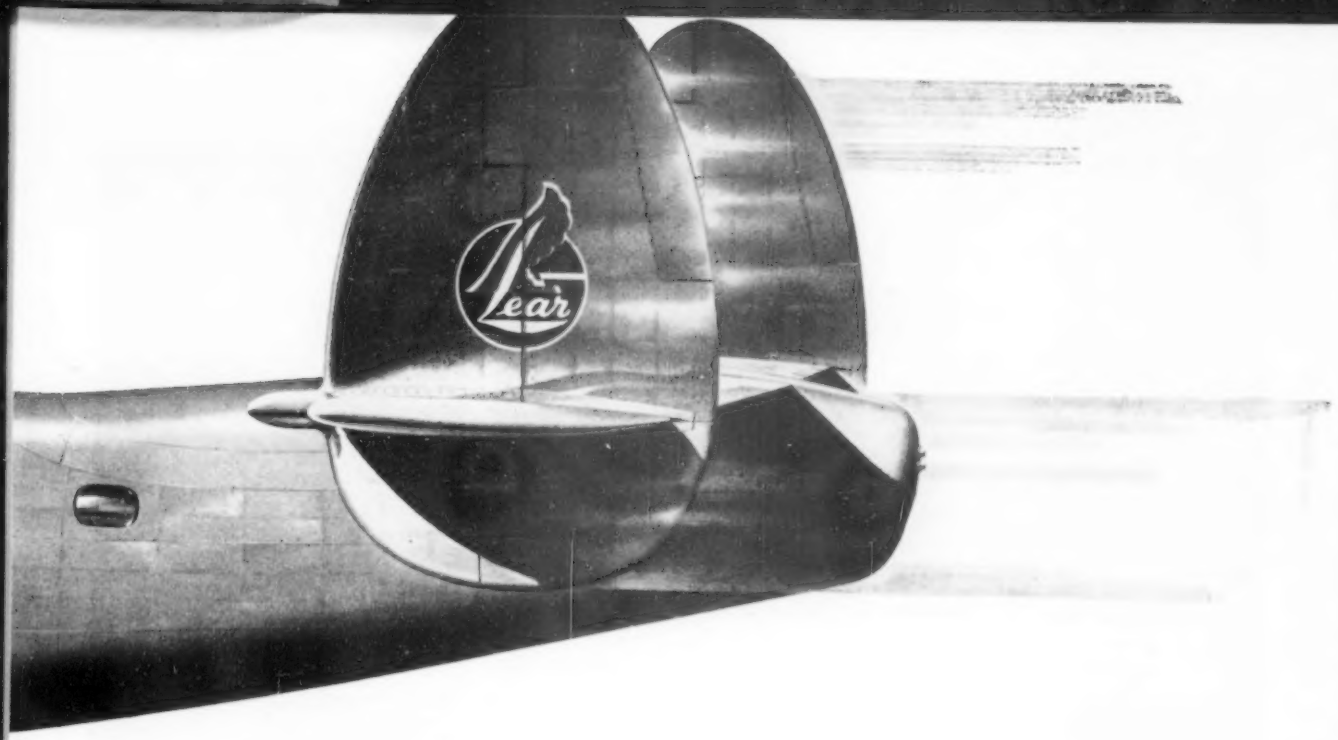
Actually, the impeller is a three-part assembly—front, intermediate and rear sections—joined at the hub by steel rings. The internal splines of the three impeller sections are aligned on assembly for engagement with the splines on the compressor impeller shaft.

The load which would be imposed by pressure plus centrifugal forces was considered to be too much for a one-piece cast impeller. Hence, the front impeller section (inducer) is an aluminum casting, while the intermediate and rear impeller sections are machined from magnesium forgings. In the latest production model (J44-R-20), the impeller will be a two-piece configuration—one casting plus one forging.

▶ **Bearing, Housing**—Forward end of the compressor impeller shaft is coupled directly (by internal splines) to the accessory shaft for rotating the gear drives. Aft end of the impeller shaft is flanged for bolting to the flanged



CANTILEVER MOUNTING feature of J44 would permit attachment to rear end of missile, as shown, without any additional aft support on the engine frame.



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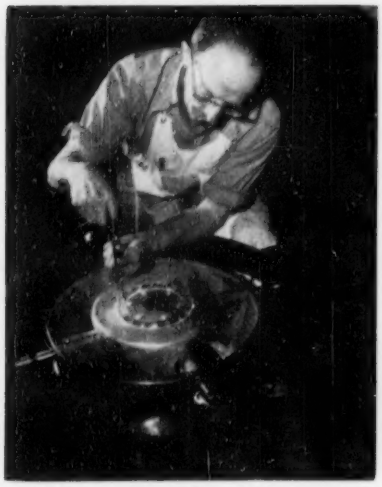
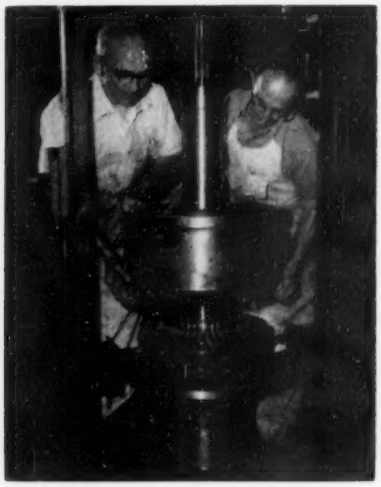
LS 1

How Fairchild Assembles the J44 Jet Engine . . .



1 Exhaust section is first major component in the jig. Bearing retainer is secured.

2 Turbine wheel with large diameter shaft fits into rear bearing with stub shaft.

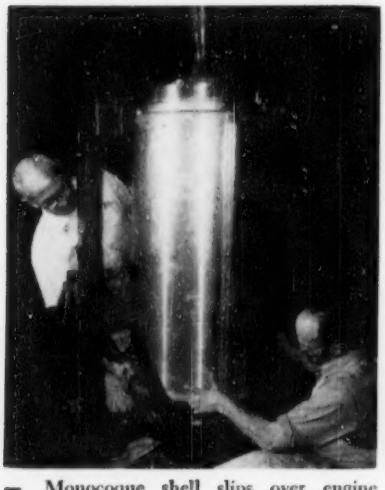


3 Turbine housing containing cast nozzle assembly is slipped over turbine shaft.

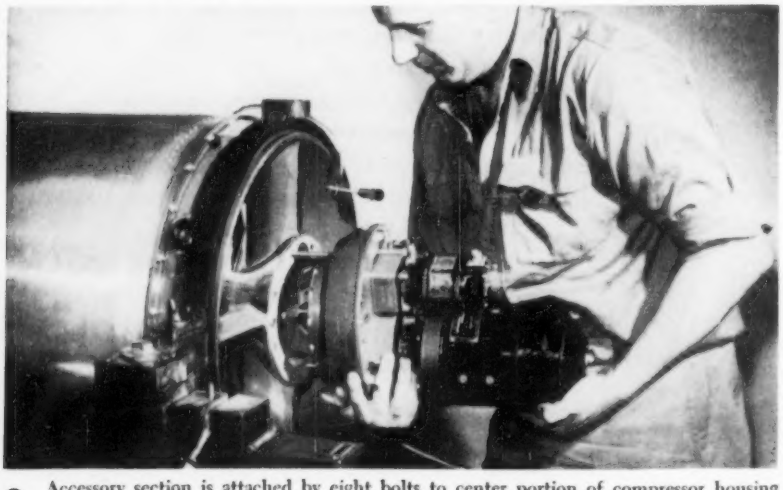
4 Diffuser with combustion chamber outer housing riveted to it is installed.

5 Impeller fits over extension shaft also used to drive gearing for accessories.

6 Compressor housing covers impeller and attaches to studs on diffuser flange.



7 Monocoque shell slips over engine body after assembly has been inverted.



8 Accessory section is attached by eight bolts to center portion of compressor housing for completion of major-assembly job. Center housing also contains front bearing.

J44 Characteristics

- Thrust, lb. 1,000
- Engine Speed, rpm. 15,780
- Pressure Ratio 2.5:1
- Weight, lb., dry (less fuel filter, tachometer generator, alternator, electrical cable and terminals, and power control actuator and linkage. 303
- Diameter, in., basic 22
- Length, in. (with accessories). . . . 75.7
- Frontal Area, sq. ft. 2.64
- Specific Weight, lb./lb. thrust. . . . 0.3
- Thrust/Unit Frontal Area, lb./sq. ft. 378

end of the large-diameter compressor-turbine shaft.

This arrangement allows a small front-bearing to be carried on the compressor shaft, instead of on the much larger turbine shaft. The small-diameter bearing, involving less linear travel for the balls, is subjected to lower centrifugal loads, hence has greater capacity to withstand gyroscopic loads of the engine.

The same step-down shafting arrangement aft of the turbine gives the same small-bearing benefits. Both front and rear bearings may be removed and replaced without disassembly of the engine.

Supported by four radial struts, the center portion of the compressor intake housing not only serves as a mounting case for the accessory section, but acts as a cage for the front bearing, as well.

Front half of the compressor housing is cast hollow to serve as a reservoir for the engine oil supply.

▶ **Diffuser Plus Can**—The diffuser is a one-piece magnesium casting consisting of an outer shell and an inner shell with 39 vanes between. Front flange of the diffuser has studs for attachment to the rear flange of the compressor intake housing.

The compressed air flows through the diffuser vanes and the velocity is decreased, with a boost in static pressure just before entering the combustion chamber.

In the new production model, the diffuser inner shell may have the vanes cast integral with it or welded to it and wrapped with a shell of sheet metal.

The stainless steel combustion chamber is annular. This configuration was selected because it is cheaper to build than incorporating a lot of cans; it is lighter, simpler to assemble. Outer housing of the combustion chamber is riveted to the rear of the diffuser's outer shell (shroud), so that the two together make a single assembly. The combustion chamber inner housing and the turbine shaft housing are riveted to the rear of the diffuser inner cone, forming annular passageways through which cooling air passes to insulate the com-

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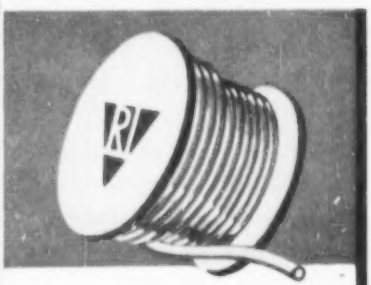

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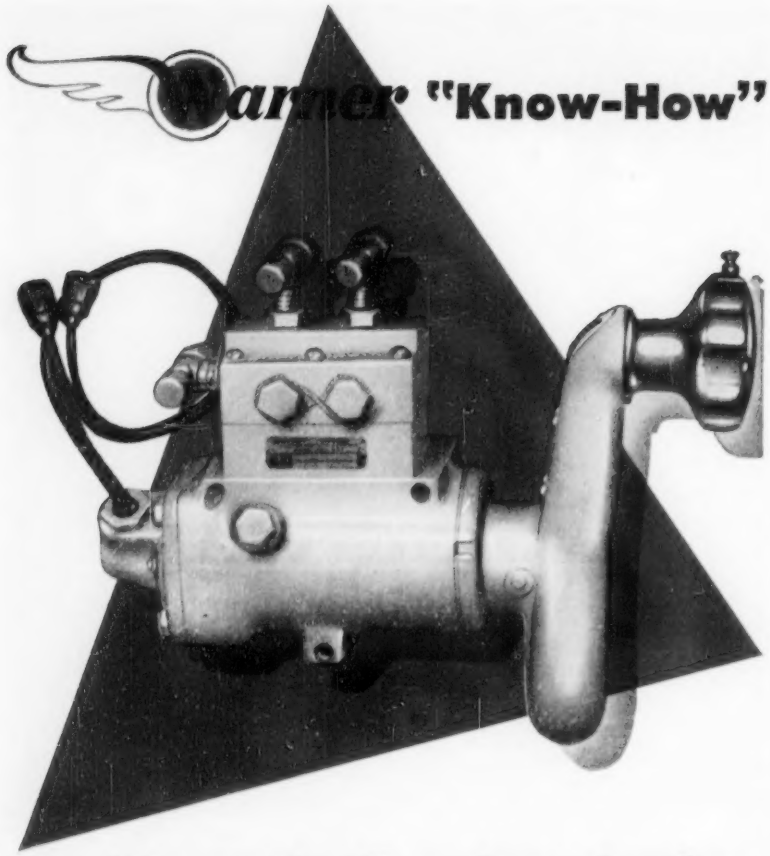

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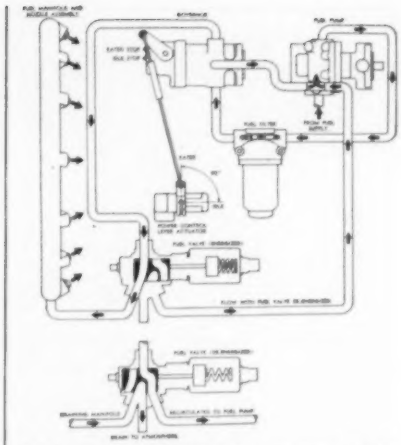


FUEL AND CONTROL system details in J44 are illustrated in this schematic.

bustion chamber from the remainder of the engine.

The combustion chamber utilizes six mounting brackets placed around the outer wall for attaching and spacing with relation to the chamber's outer housing.

▶ **Chamber Flow**—The greater portion of the air from the diffuser enters the chamber through two annular passageways. One of these is formed by the inner wall of the combustion chamber and its inner housing. The second passageway is formed by the outer wall of the combustion chamber and its outer housing.

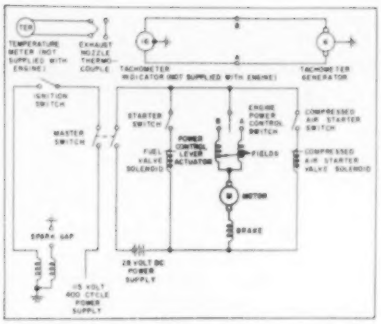
Air through these passages enters the combustion chamber through a series of openings in the inner and outer walls, mixes with the hot gases resulting from fuel burning in the primary zone and lowers the temperature to a value suitable for entering the turbine section.

▶ **Nozzle Data**—Spaced around the combustion chamber dome are 12 holes to accommodate the fuel nozzles. These nozzles—fixed-orifice units carried on a manifold—are similar to the home oil-burner-type, but have a bigger opening. They are rated at 18 gal./hr. Each nozzle costs about 80¢, Fairchild engineers say.

Checks are run on the nozzles to get a group of 12 with the same relative spray characteristics. This selective procedure takes time, but is permissible because of the inexpensive nozzles used.

▶ **Turbine Area**—The turbine housing assembly consists of an annular shroud welded to a turbine nozzle. The nozzle is a one-piece casting with stator vanes and vane shrouds integral. Front end of the nozzle inner shroud supports the turbine shaft housing, while the turbine housing supports the rear of the combustion chamber housing.

The turbine disk has 46 high-temperature cast blades welded to its periphery. Space between the blade root webs serves as a passage for cool-



ELECTRICAL wiring diagram indicates circuits for J44 operation.

ing air. This cooling air reduces heat transfer from the blade to the disk rim and to the turbine shaft extension on the rear of the disk. This small stub shaft allows the use of the small rear bearing, outside the turbine area.

A flanged hub on the front of the turbine disk provides for a bolted attachment to an external flange on the turbine shaft. This is a departure from the conventional practice of having the turbine disk and shaft integral.

In the Fairchild design, the turbine shaft is a large-diameter seamless piece of tubing. Its large diameter gives it sufficient torsional rigidity so that only the two bearings are required.

An internal flange on the front end of the large-diameter shaft connects to the compressor shaft.

The exhaust section is comprised of the nozzle, a nozzle extension, the turbine rotor support assembly (the rear bearing cage) and hollow struts.

▶ **Monocoque Shell**—Military requirements specified that the engine would have to have an enclosure. Fairchild engineers reasoned that they might as well put this enclosure to work. This plan resulted in a strong monocoque aluminum alloy cowl, sufficiently light so that one man can lift four of them. This monocoque shell supports the aft end of the engine, affording enough rigidity to permit cantilever mounting at the front end of the engine.

This is the method for mounting in the Firebee, and is also applicable for engine attachment to the aft end of a missile. Even in parachute recovery of the Firebee, where the rate of descent is about 16 feet per second, the mounting and the entire engine structure stands up.

A machined flange riveted to the forward end of the cowl carries 24 studs for attachment to the compressor intake housing. The aft end of the monocoque shell is bolted to the tapped ends of the struts radiating from the rear bearing cage. In the new production model, the cowl will extend only between the compressor housing and nozzle housing.

A removable plate in the cowl gives

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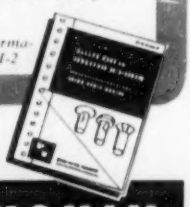

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access to the single sparkplug in the combustion chamber.

Turbine loads passing into the rear bearing are transmitted to the bearing housing and from there to the struts. From the struts the load is transmitted to the monocoque shell, which carries it forward to the front end of the engine at the mounting flange.

A hole on the engine mounting flange receives a dowel located in the mating flange on the airframe. This gives a means of indexing the engine on the airframe as well as a method for preventing rotation of the engine with respect to the mount. The ring-type clamp surrounding the engine and airframe flanging not only permits rapid installation of the jet in the plane but also would allow quick jettisoning of the engine during flight.

▶ **Cooling Scheme**—Some of the air led into the diffuser cavity passes between the turbine shaft and its housing, then flows along the front face of the turbine disk, and passes into the exhaust area through the passages between the root web of the turbine blades.

Cooling air also flows between the combustion chamber housing and the engine cowl, passing into the turbine bearing cage through one of the support struts.

This entire internal flow is meant to prevent hot exhaust gas from entering the turbine bearing cage, reduce cowl temperature at its rear end and to direct lubricating oil against the turbine bearings.

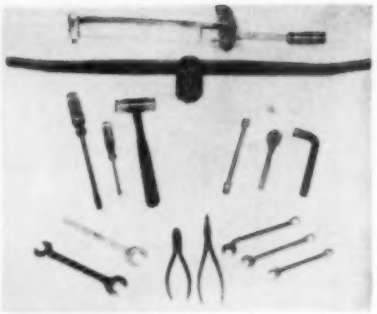
Four scoops mounted on the aft end of the engine collect ram air and direct it through the sheet metal strut housing to the rear bearing cage. This air exits through the inner tail cone of the exhaust nozzle. When ram air is not available, as during ground operations, a funnel-shaped diffuser connected to the inner tail cone serves as an ejector for drawing cooling air through the four scoops and the bearing cage.

In the latest production version of the J44, these rear scoops will be eliminated because improvements will insure enough air supply to the bearing even during ground operation.

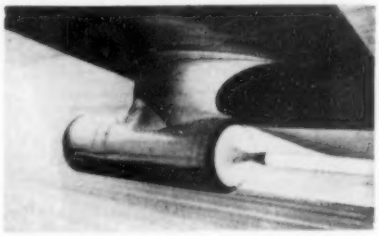
▶ **Lube System**—The J44 uses a non-return lubrication system. This eliminates many sealing considerations—for example, rotating seals are eliminated completely.

Compressor air does the job of a pump. Oil in the integral reservoir of the compressor intake housing is kept under pressure from the impeller discharge. This pressure forces the oil through a small orifice directly ahead of the compressor bearing. Pressure air also passes across the orifice to give a spray effect around the bearing.

The turbine bearing is lubricated in much the same manner. An oil line



TOOLS required for engine's assembly or disassembly include only one special unit, compressor shaft-nut wrench, shown under torque wrench at top.



POD MOUNTING for engine would use trunnions (inside the shell) plus an aft support (inside fairing) on rear bearing frame. This differs from mounting on end of a missile, which is cantilever support.

connects the reservoir with one of the rear-bearing-housing struts, for a pipe to carry the oil directly to the rear of the turbine bearing. Air from the cowl passage blows across the end of the pipe to give a spray enveloping the bearing. The spray is then vented out the tailcone.

▶ **Fuel System**—Fuel from the fuel pump passes through a filter to the governor. Flow through the governor is metered by a sliding valve, whose movement is controlled by flyweights rotated by the accessory drive. A differential relief valve in the governor bleeds pressure from the fuel pump to maintain 75 psig. above engine requirements.

Fuel from the governor passes through a nipple in the accessory drive housing. The nipple is aligned with a drilled gallery in the compressor intake housing. The gallery in turn communicates with the fuel line connected to the intake port of a fuel valve mounted on the compressor housing.

The fuel valve is actuated by a continuous-duty solenoid. When the solenoid is energized, fuel flows through the valve to the fuel manifold. When the solenoid is de-energized, the valve closes and fuel is bypassed inside the valve and recirculated to the fuel pump. Another bypass in the valve permits all the fuel remaining in the fuel manifold to be drained overboard.

▶ **Power Control**—Power output of the engine is controlled by the governor,

which in turn is controlled by movement of a power-controlled lever actuator. When the actuator is energized, its arm travels through an arc and attached linkage transmits movement to the throttle lever of the governor. This lever puts a load on the governor flyweights and in turn these are coupled to the metering valve.

A constant engine-rpm. is maintained according to the requirements established by the actuator.

▶ **Electrical**—The electrical system includes the tachometer generator, alternator, an actuator, fuel valve solenoid, ignition coil, sparkplug, exhaust nozzle thermocouple, and associated wiring and connectors.

All wires are connected to a disconnect assembly for attachment to the electrical system of the airframe.

▶ **Buildup Easy**—Basic scheme for building up the J44 on the assembly floor is a simple one:

- **Assembly starts** with the installation of the exhaust section in a simple vertical jig.
- **Rear bearing** is installed and retained in the bearing housing.
- **Turbine and shaft** assembly is inserted.
- **Turbine housing**, containing the nozzle, is slipped over the turbine shaft.
- **Diffuser and combustion section** is slipped over the turbine shaft.
- **Impeller** is installed.
- **Compressor housing** and front bearing assembly are attached next. At this point, the jig is reversed around pivots, so that the aft end of the engine is up for next step.
- **Monocoque shell is** slipped over the engine for fastening to aft end of compressor housing and struts of exhaust section. This fundamentally completes the assembly, except for the installation of the accessory section on the front bearing housing.

Assembly or disassembly of the engine requires relatively few tools. The only special tool required is a compressor shaft-nut wrench.

Stanley Plans New Aircraft Factory

Stanley Aviation Corp., Buffalo, N. Y., is preparing an industrial site near Denver for construction of a $500,000 plant to house a substantial part of the company's present operations.

President Robert M. Stanley says the new Denver plant will be ready to begin operations next spring. Bulk of the company's production activity eventually will be transferred from Buffalo to Denver. There will be about 300 fewer employes at the Buffalo plant, which now employs 550 workers.

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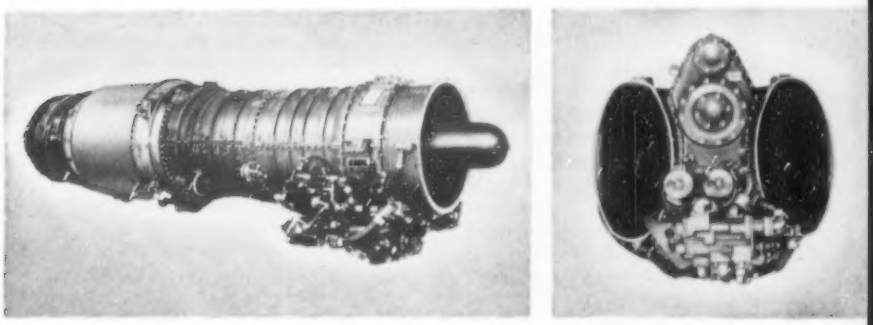

Side view of Westinghouse J34 turbojet and front view of J40 turbojet, showing the singular Westinghouse feature of small diameter and reduced frontal area.

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• Faster learning, greater safety are among advantages company sees in Model 72's seating arrangement.

SIDE-BY-SIDE SEATING of instructor and pupil in the Model 72, Ryan Aeronautical Co.'s entry in Navy primary trainer competition, could start U. S. trend.

San Diego, Calif.—Ryan Aeronautical Co. has revived interest in the idea of a side-by-side primary trainer for U.S. military pilots with its entry of the Model 72—a modified Navion—in the Navy's primary trainer competition at Pensacola, Fla. (AVIATION WEEK Oct. 12, 1953, p. 25; Nov. 2, p. 26; and Nov. 16, p. 7).

The other contestants are Temco's Plebe and Beech's Mentor.

▶ **Not New**—Side-by-side flight training for military pilots is not new.

Many U.S. cadets trained side-by-side for World War II in basic and advanced flight school in such trainers as the AT-17. Britain has several advanced side-by-side trainers such as the de Havilland Vampire and the prototype Avro 707 delta trainer.

Sweden has a side-by-side primary trainer, the Saab SK.50 Safir.

Significance of the Ryan shift, however, is that the firm formerly was one of the foremost builders of conventional tandem trainers, well known to World War II cadets.

Ryan not only built primary trainers but also operated flight schools for AAF cadets, thus gaining a great deal of experience in the initial training of military pilots. For this reason, Ryan's switch from tandem to side-by-side design will receive serious attention, regardless of the merits of the aircraft it has entered in the Navy competition.

▶ **Side-by-Side vs. Tandem**—The firm now believes the side-by-side trainer offers many advantages over the old style.

Ryan engineer and Washington representative G. C. Danch has made a technical study of the advantages of side-by-side vs. tandem trainers which the company feels builds a strong case for the side-by-side primary flight trainer.

Tendency in the U.S., with its PT and BT series and AT-6s in both Air Force and Navy versions, has always been toward the fore-and-aft seating of student and instructor. But Danch argues that a study of the fundamentals of flight training may show this design to be based on faulty reasoning.

Although psychologists agree that the audio-visual combination is the most important element in the learning process, Danch points out, a tandem seating arrangement penalizes this factor.

"To a considerable extent, the ability of both student and instructor to derive maximum benefits from audio-visual learning depends on the proximity of the student and his instructor," says the Ryan engineer. "Audio-visual means that we learn primarily through what we see—observation; or what we hear—communication."

▶ **Audio-Visual Learning**—A student observing an instructor demonstrate a flight maneuver learns from three things, Danch says:

• **Watching the motion** of the airplane with respect to the horizon.

• **Following through** and watching the motions of the cockpit controls.

• **Watching the instructor's** physical actions during the maneuver.

He believes side-by-side seating offers the maximum potential for these.

Of the other half of the combination, audio learning, Danch has this to say: "An explanation or instruction over an intercom is generally not as satisfactory as a directly spoken communication. Factors such as clarity, noise-free character and fidelity of the intercom system will all affect the student's understanding."

▶ **Primary Training**—Noting that the basic purpose of primary flight training is the acquisition of new skills by the student, Danch lists these problems which the student must overcome to acquire the necessary skills:

• **He must overcome any fear** of his new environment. He must acquire confidence in the airplane, the instructor and himself.

• **He must develop** the proper motor coordination skills necessary to initiate and maintain a desired attitude or perform a given maneuver.

• **He must acquire** the judgment necessary to perform safe solo flights, through experience and practice.

• **He must become familiar** with procedures, routines and proper operation of the airplane and its controls and components.

A supplementary objective, Danch points out, is the early weeding out of those students who are unsatisfactory pilot material.

"Satisfactory attainment of these objectives of primary flight training is obviously dependent to a considerable degree upon the functional arrangement of the flying classroom," the Ryan engineer says, adding that the ideal training arrangement should not hamper in any way the instructor's objective of constantly monitoring and evaluating his student's progress.

▶ **Side-by-Side Advantages**—With those objectives in mind, he lists these advantages for the side-by-side primary trainer:

• **Improved instructor visibility.** "The one most common complaint heard from all instructors who have to ride the back seat is the limited visibility from this position. Significantly, the majority of these complaints are in connection with visibility during the

landing approach, a time when the instructor most needs maximum visibility."

• **Improved instructor evaluation of student.** "In a tandem arrangement the instructor must rely almost entirely on indirect, external signs or indications of the student's progress. . . . In the side-by-side trainer the instructor is completely unhampered in his function of monitoring the student."

Danch notes that the instructor, continuously observing the student's reactions, can detect signs of tension or fear and directly observe the student's response to instructions.

• **Reduction of instructor tension.** "The instructor is not under the constant strain of trying to detect danger signals through second-hand indications as in the tandem. . . . It is easier and safer for the instructor to stop a student's hand reaching for the wrong control, than it is for him to worry about it while watching for movement of the right control in his cockpit."

• **Improved student learning rate.** "Since the instructor is not removed from the student, the tendency to correct students too soon will be lessened and as a result a student will learn faster." Proximity also encourages asking of questions, Danch points out.

• **Improvement of teaching techniques.** "In tandem trainers it is impossible for the instructor to judge whether he has said so much that the student is confused or said so little that the student cannot fill in the gaps. In a side-by-side trainer the instructor would be better able to judge the amount of verbal instruction required by the student for a clear understanding of what is being taught." The instructor also is able to make maximum use of the demonstration technique in teaching, Danch points out.

• **Reduction of student apprehension.** "One problem to be overcome early in the student's training is his lack of confidence and his apprehension. In a tandem arrangement, where the student has no contact with the instructor except over the intercom, this apprehension or tension of the student is heightened. In the side-by-side, the student is able to observe the relaxed manner of the instructor, he sizes up the instructor's ability more quickly and he notes the ease and apparent simplicity with which the instructor does the job of flying the airplane. With the reduction of his tensions and increasing familiarity with his surroundings, his progress is considerably speeded up," Danch says.

• **Increased safety.** "In the tandem the instructor must either be prepared for movement of the wrong control by the student by holding that control down during the critical period or his action to correct the control movement will come after the fact. In side-by-side, the instructor finds it considerably simpler to prevent the student from moving the wrong control than he does in the tandem."

Not only will accidents resulting from difference in readings of front and rear cockpit instruments be eliminated, but misunderstandings between student and instructor will be reduced, says Danch, commenting: "Everyone has seen the cartoon showing an airplane on its nose, with the student telling the instructor 'But I thought you had it.'"

• **Reduction in dual training time.** Improved teaching and learning environment will shorten dual time necessary, both before and after solo, Danch claims.

• **Reduction of maintenance problems.** Elimination of much duplicate equipment will reduce maintenance and supply problems, increasing inflight time of aircraft, according to the Ryan engineer.

"Through experience," says Danch in conclusion, "the services' flight training programs have evolved into efficient and well-organized pilot training schools. The only major area where it would appear that further gains can be made is in the improvement of the airplane to make it a better tool with which to train the pilots. Any sought-for improvement could hardly be better than the change to a side-by-side trainer and the opportunity it provides for making full use of the known and proven concepts of audio-visual learning."

Many persons will take exception to the views expressed by Danch. There are many arguments against side-by-side seating which he has not touched upon.

Nevertheless, decision of the Navy instructors at Pensacola, who must decide whether they like Ryan's Model 72 side-by-side trainer in preference to the two conventional trainers entered in the competition, will be a vote for or against a major change in primary flight training techniques. —WJC

B-52 Mockup 'Flight' Checks Crew Factors

Boeing Airplane Co. has been using the B-52 mockup for a series of checks and studies of the crew accommodations. A crew from Strategic Air Command, properly dressed for high-altitude flight, recently spent four days in mock flying and operation of the big jet bomber. Scientists from the Human Factors Directorate of the Air Research and Development Command and flight surgeons from the Aero Medical Laboratory joined with Boeing engineers to watch and take notes during the "flight" program.

The crew varied in height from a minimum of 5 ft. 6 in. to a maximum of 6 ft. 3 in. During the four-day study, they went through all the motions of routine missions at each crew station.

Lockheed Rocket Model Test

Extremely thin, constant-chord wing is mounted on motor section of a standard 5-in. high-velocity aircraft rocket (HVAR) for economical flight tests at high speed. Camera under fairing near nose photographs behavior of model wing during test. Bent tab near leading edge of right wing panel is apparently an identifying card which is taped to the surface and will rip off as flight begins. Model's wing layout could be that for Lockheed Aircraft Corp.'s new F-104 lightweight fighter.

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Huge Metal Bellows On Way to NACA Lab

Biggest stainless-steel bellows in the world have been built by Solar Aircraft Co. for NACA's new supersonic wind-tunnel at the Lewis Flight Propulsion Laboratory, Cleveland.

Thirteen of the flexible expansion joints were built, ranging from five to 28 ft. in diameter. Solar used special techniques to fasten the stainless-steel convolutions to carbon-steel pipe ends.

Because of the bellows' large size they must be shipped from Solar's plant in San Diego to Cleveland by a carefully planned water route through the Panama Canal to New York, and thence up the Hudson River to Lake Erie and Cleveland.

Cincinnati Advances Engineer Schooling

Unexpectedly large response to a program of part-time graduate courses for practicing technicians conducted by the University of Cincinnati has forced closing of some classes at maximum enrollment, and the formation of additional sections.

The program was developed as a joint effort by the University, a local industry committee and the engineering societies as part of the nation-wide effort made by the Engineers' Council for Professional Development.

Aim of the ECPD program is to continue the personal and technical growth of the young engineer, particularly in the first five years after his graduation.

A total of 285 engineers and scientists enrolled in the nine courses made available, covering the range of subjects from analytical chemistry to strength of materials.

The series is the first in a planned sequence to meet the needs of college graduates, and to enable young men to study at advanced levels while employed in the Cincinnati area.

Advanced courses in mathematics and science may be integrated with the appropriate courses in engineering to compose degree programs.

AiResearch Sponsors Air History Course

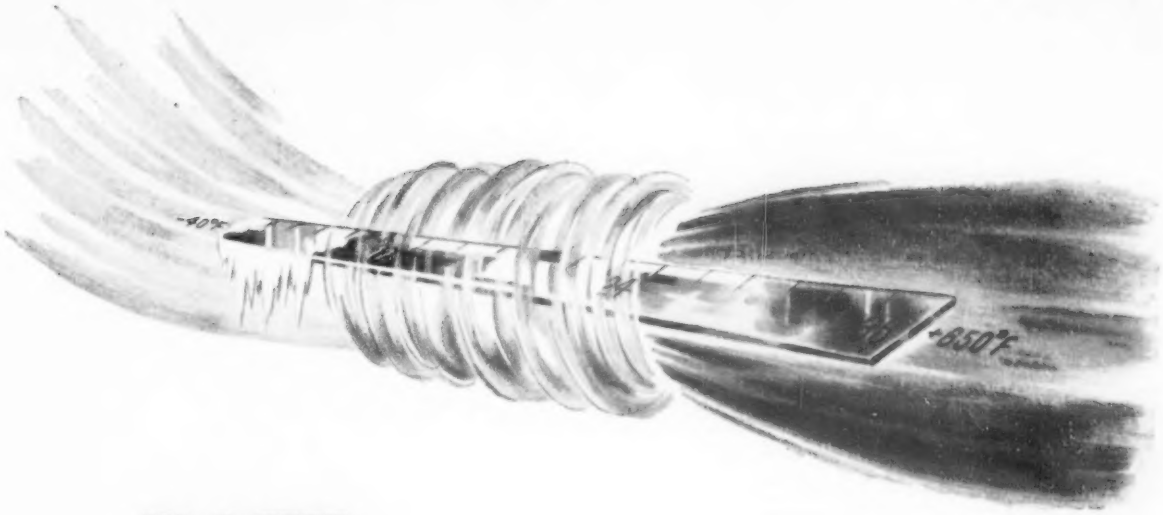
A fund for the support of research and teaching in the history of science has been established at the California Institute of Technology by the AiResearch Manufacturing Co., Los Angeles.

A three-year program will be sponsored by the fund of $56,000 and will introduce two innovations at CalTech: a general course in the history of science, and a research project in the history of flight under pressurized conditions.

Director of the program will be Dr. Rodman W. Paul, professor of history; Dr. Thomas M. Smith, recently appointed assistant professor of the history of science, will teach the new course, conduct the study and write the history.

Seeing For Themselves

During inspection visit of Fairchild Engine Division facilities at Farmingdale, N. Y., Lt. Gen. Donald L. Putt (second from left), Commander of the Air Research and Development Command, and Brig. Gen. Leighton Davis, ARDC's Assistant for Development and Supporting Research (second from right), get lowdown on technique for mass-producing jet engine turbine blades from George F. Chapline (right), general manager of the Engine Division and vice president of Fairchild Engine and Airplane Corp. L. Paul Ahlers, Chapline's executive assistant, looks on at left.



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"When you call in Parker for engine accessories, we can offer fast service on everything from proposals to shipments," explains R. P. McDonald, Parker sales engineer. He continues . . .

"Let me briefly describe these accessories for engine *hot-air* systems, from left to right. Our shutoff valve and pilot valve, used in nozzle cooling, are both extremely simple in design. The butterfly valve can operate at 500°F ambient and handle air up to 700°F.

"Shown on the right-hand page, our anti-icing and de-icing valves help keep an engine's air-intake section free from ice. Each can handle air up to 600°F. With seal modification, the de-icing valve will carry air up to 900°F. The motor-actuated shutoff valve assembly, shown on the far right, is available with rotor, butterfly, shear-plate, or poppet construction.

"Parker has centralized all engine-accessory engineering and manufacturing into a single operating division. Here you'll find engineers working to design accessories that offer not only extra performance benefits but also cost savings. Because quality depends largely upon precision manufacturing, you'll also find we use the most advanced manufacturing techniques and many one-of-a-kind machines. And, the inspections and tests that each accessory must pass prove Parker customers get what they order.

"Having a specialized group of customers, we are able to gear these facilities to a faster, more streamlined way of doing business.

"Whether you are interested in engine accessories for *hot-air* systems or for *fuel* or *hydraulic* systems, why not call us in? We'll be glad to discuss your requirements and offer assistance."

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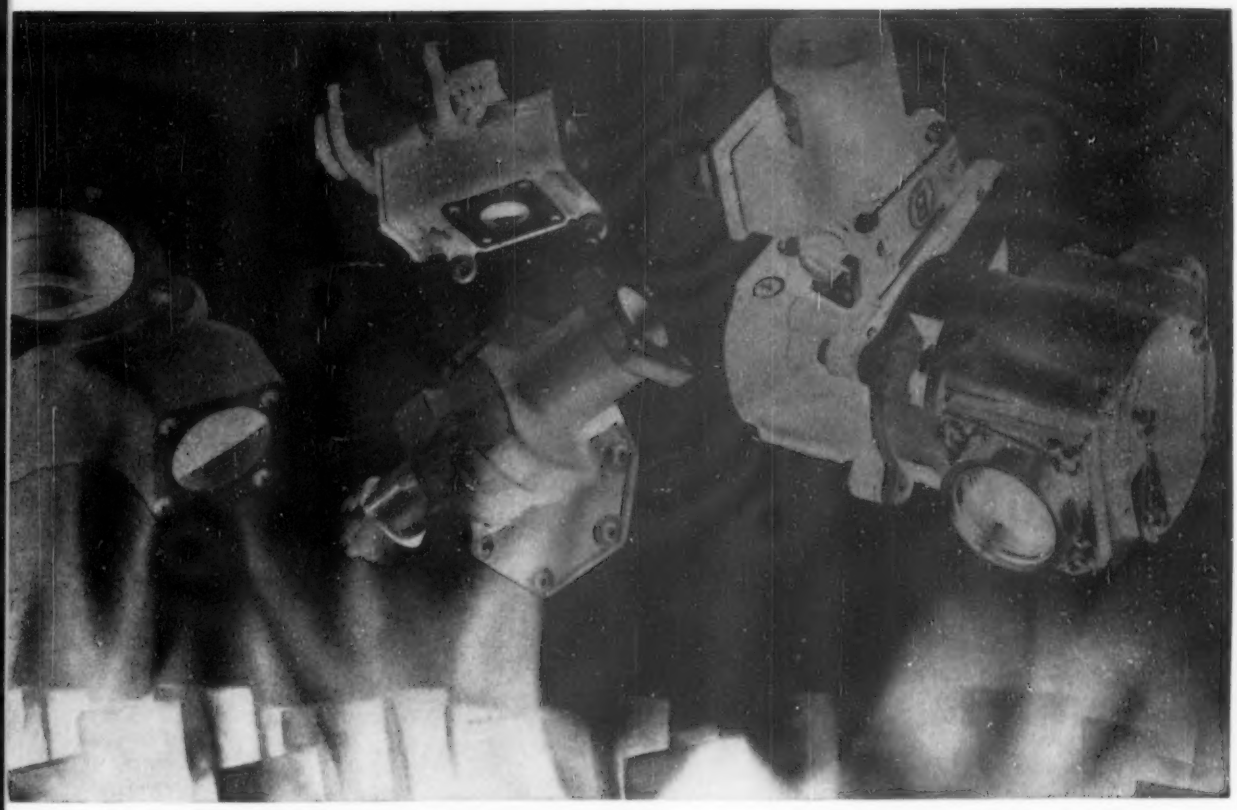
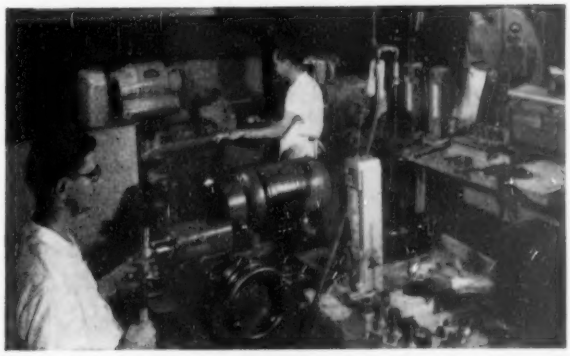
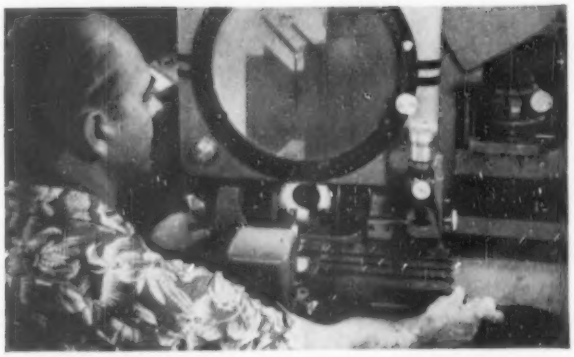




Precision grinding (shown above) on these stainless steel parts is checked to within 0.0001-inch accuracy. Grinders are able to hold 0.0002-inch concentricity between diameters.



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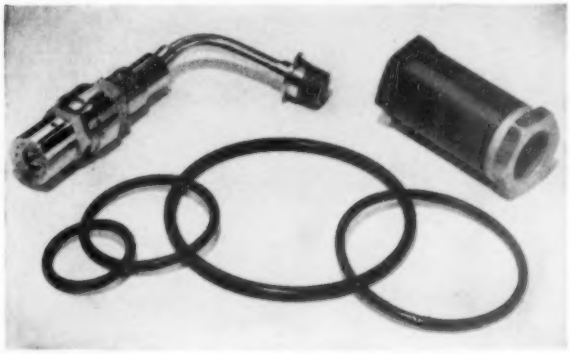

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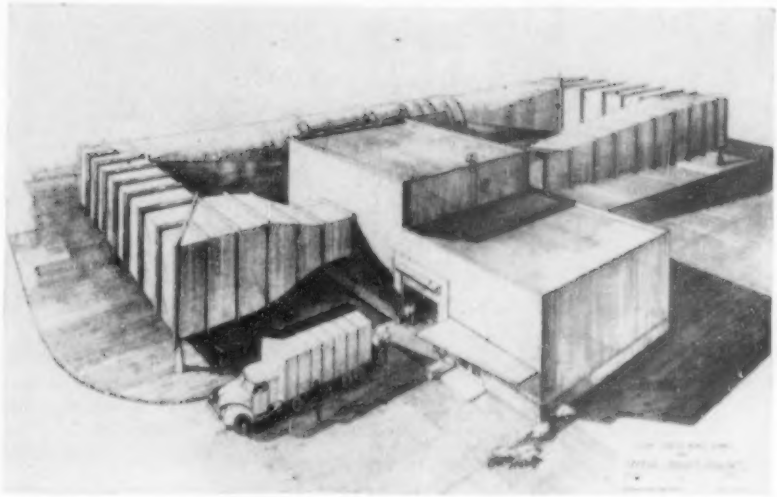

Vought Erecting Own Windtunnel

Add Chance Vought to the growing list of aircraft firms which own or operate their own windtunnels.

The Dallas firm is putting about one million dollars of its own money into the construction of a lowspeed tunnel to aid its aircraft and guided missile programs.

Test speeds up to about 200 mph. will be within the capacity of the new facility.

Bids for construction have been opened and the tunnel should be completed one year after placing the order, the company estimates.

▶ **Need for Unit**—Chance Vought, in common with other companies, has been using a variety of test facilities within the U. S. It will continue to make use of highspeed tunnels at United Aircraft Corp. and Cornell Aeronautical lab after the new unit is finished.

But according to A. I. Sibila, Vought's assistant chief of aerodynamics, utility is the primary reason for constructing the tunnel in Dallas. He explained that test requirements have grown to the point where an immediately available tunnel is essential to meet schedules.

The 200-mph. figure is not to be ridiculed in the jet age, either; lowspeed testing has become increasingly important, Sibila said. For instance, the sweepback which permits an airplane to increase its critical Mach number may make it difficult to control at low speeds and high angles of attack.

▶ **Description**—The tunnel will be housed in a building about 60x150 ft. Power for driving the 20-ft. fan will come from a 1,500-hp. electric motor. Windtunnel's test section dimensions are 7x10 ft.

Loads will be measured on a six-component balance system. Automatic printing of the data will be done for permanent reference.

Model attitude and airstream speed will be remotely controlled from a console.

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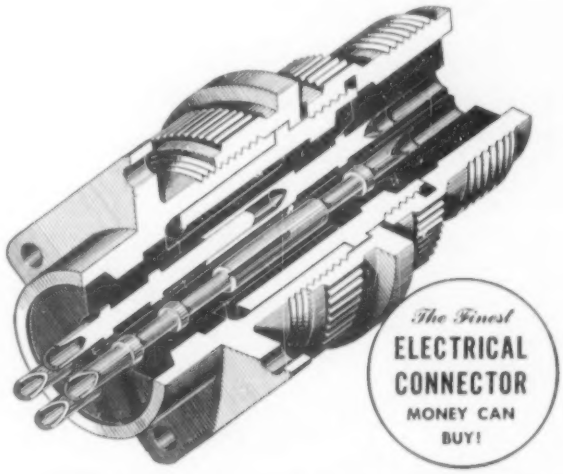

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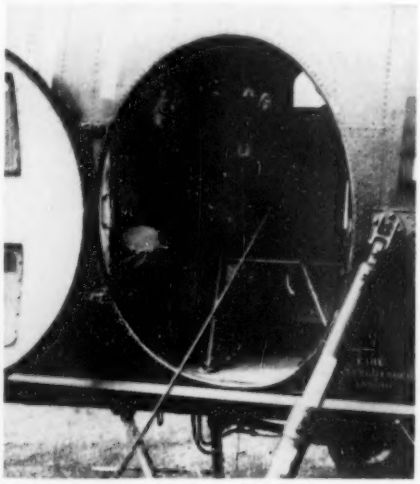
Army Copter Lays Phone Line

Versatility of the copter for carrying out Army Signal Corps missions is being explored thoroughly at the Corp's Aviation Center, Ft. Monmouth, N. J. Typical of the tests being run is installation of phone and radio communications, ordinarily subject to delays, hazards and slow pace of conventional ground transportation.

The Army Aviation Center has used the Piasecki H-25A Army Mule not only to install the lightweight aluminum telephone poles and string wire across them, as depicted on this page, but also to survey the site and transport technicians to put the finish touches on the installation.

1 Phone pole slung vertically beneath Piasecki H-25A can be dropped easily into prepared holes dug previously by airlifted linesmen.

2 Ground crew, brought to the spot by the Signal Corps H-25A, merely has to secure the phone pole. Note uneven terrain, easily accessible by helicopter.



3 Spiral cable reel is installed inside the copter, ready to feed phone wire along the route.

4 Flying sideways, a routine helicopter maneuver, the Army Mule accurately lays the phone cable directly onto the crossarms of the erected telephone poles.

5 All the Signal Corps linesman has to do now is secure the cable to the pole's crossarm.

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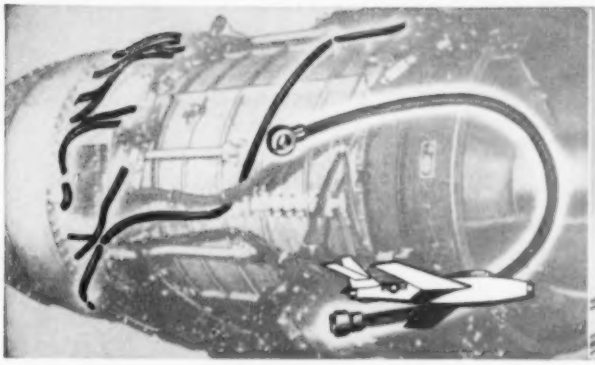
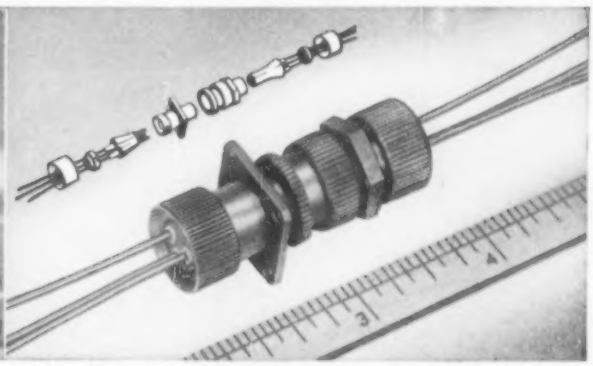


DEPENDABLE FUEL FEEDING. Fuel for the J65 Turbojet Engine is injected to the burners through Titeflex® flexible metal hose. Tough, lightweight Titeflex—tested for temperatures from —70°F. to +600°F. and for pressures up to 500 psi—reliably conveys fuel to engine nozzles; withstands vibration and rough use; is excellent for complex configurations.



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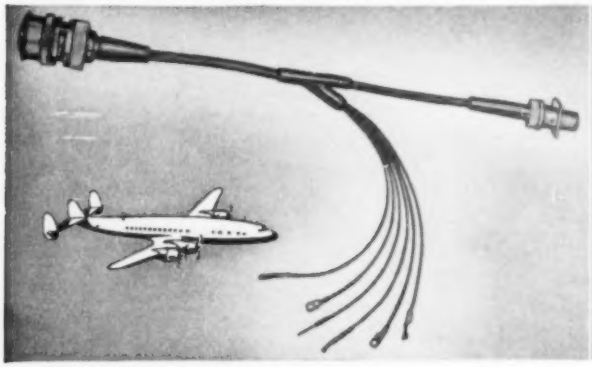
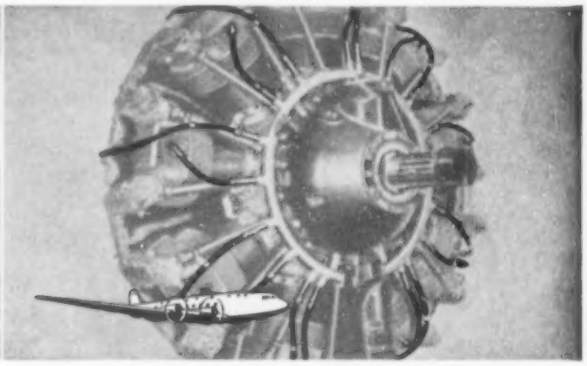


CUSTOM WIRING SYSTEMS. Titeflex specializes in designing and building special "packaged" wiring systems and component assemblies for today's complex aviation and guided missile installations. These may be jacketed with protective silicone or other compounds—and Titeflex Special Connectors used as integral parts solve complex wiring problems.



RADIO SHIELDING. Titeflex Harness for reciprocating engines is our specialty. Titeflex makes a wide range of standard ignition harnesses meeting rigid aviation specifications—can also supply component parts, such as serviceable leads for military and commercial aircraft. Titeflex application on Wright R 1820 Engine includes harness and leads.

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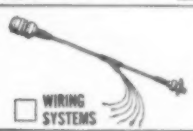

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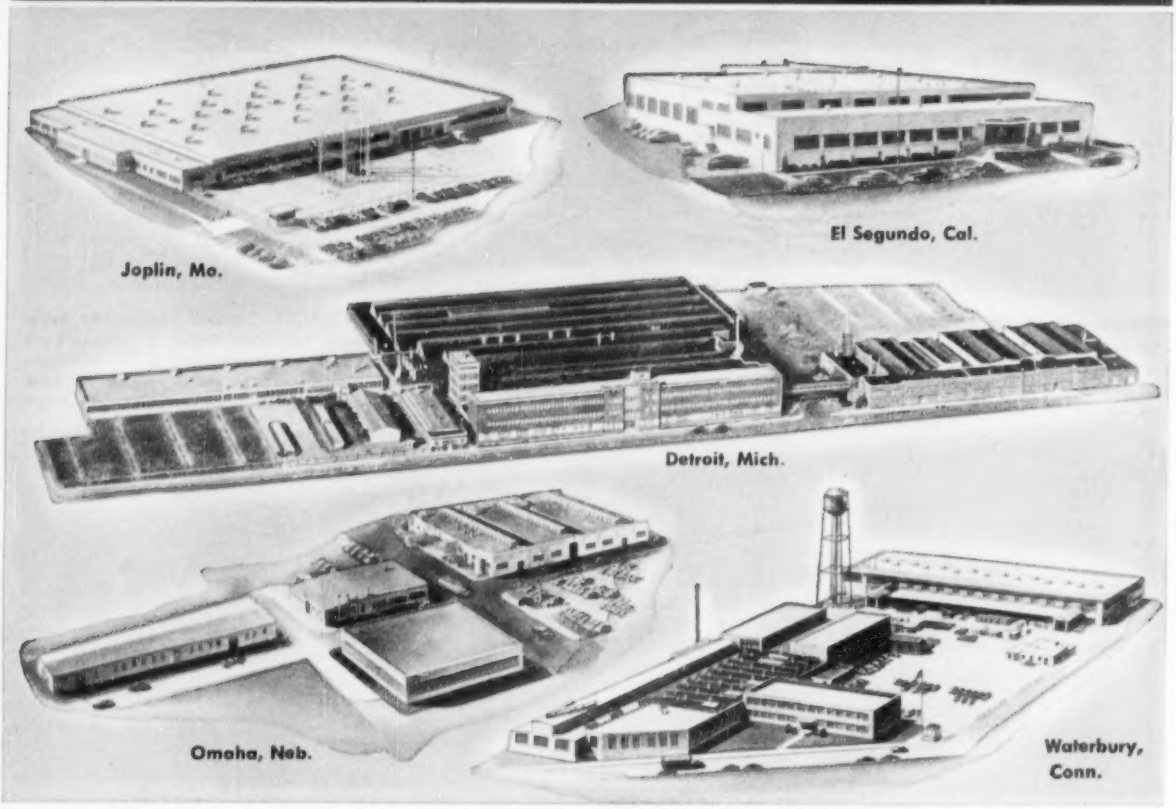

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6627

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

BuAer Contracts

The following contract awards of $25,000 and more have been announced recently by the Bureau of Aeronautics, Department of the Navy, Washington 25, D. C.

CORNELL AERONAUTICAL LABORATORY, INC., Buffalo, N. Y., continue the development of lean substitutional alloys for high-temperature applications; evaluate properties of more promising alloys developed; monthly and final reports, $29,938.

GENERAL ELECTRIC CO., Schenectady, N. Y., amplifiers, 183, amplifier racks, 183, computers, 183, computer racks, 183, controllers, 183, directional gyro units, 183, spare parts; drawings; publications; recommended lists of overhaul and line maintenance tools and test equipment, $40,131.

JACK & HEINTZ, INC., Cleveland, Ohio, 40-kva. constant-frequency, variable- speed a.c. generators, 3, a.c. regulators, 3, drawings, reports, $244,180.

TEMCO AIRCRAFT CORP., Dallas, Tex., services and material to provide progressive heavy maintenance periods for R7V-1 aircraft in accordance with "Specification 1400-hour heavy maintenance period R7V-1 Aircraft" and specification outline dated 15 Aug. 1953; engine changes and engine accessory overhaul; de-seal and re-seal of fuel tanks, 40, $832,437.

AMERICAN CHAIN AND CABLE CO., INC. (Manley div.), York, Pa., redesign the Mark 2, Mod. 2, bomb truck, increasing the capacity from 2,500 lb. to 4,000 lb. and furnish two prototypes of the modified model. Drawings, handbooks, pattern equip. and tooling, $31,500.

BENDIX AVIATION CORP., Eclipse Pioneer div., Teterboro, N. J., controllers, lighted stick type, 611 ea., spare parts, $13,280.

CAMFIELD MFG. CO., Grand Haven, Mich., bomb shackles, Mk. 8, spare parts, 4,117 ea., $156,335.

CONSOLIDATED INDUSTRIES INC., West Cheshire, Conn., acquisition, rehabilitation and installation in the contractor's plant of machine tools and other capital equip. required to increase or improve the capacity of said plant for the production of steel, aluminum, magnesium and titanium forgings for prime airframe and engine suppliers of the government, $193,486.

COOK ELECTRIC CO., Cook Research Lab div., Chicago, Ill., redesign and modify cloud level indicator, fabricate and calibrate not less than 36 cloud level indicators; conduct field tests; reports, drawings, specifications, $40,669.

COX & STEVENS AIRCRAFT CORP., Mineola, L. I., N. Y., services and materials necessary to furnish the following items as may be job ordered from time to time during the period from Oct. 13, 1953, through Dec. 30, 1955: (1) furnish engineering sample design of each model load adjuster for one model of aircraft including instruction pamphlet; (2) furnish engineering sample redesign of each production model load adjuster including revised instruction pamphlet, 2; (3) rework obsolete government-owned load adjusters to new design (minimum order per model shall be $175.00), 1,000, $10,000.

HILLER HELICOPTERS, Palo Alto, Calif., kits of parts for installation of full phasing double caged type sprag clutch in HTE-1 and HTE-2 helicopters, 125 ea., $71,644.

W. L. MAXSON CORP., New York, N. Y., during fiscal year 1954 the contractor to furnish the services of two technically trained employes to provide technical assistance and instruction in the maintenance, operation and serving of gunsight controller Aero 2C, range throttle grip Aero 4C, and radar range servo Aero 1A, used by the Navy and Marine Corps in aircraft fire control system of various aircraft. The services to be rendered at such places within & without the continental U. S. as may be required from time to time by the Bureau of Aeronautics, $29,636.

Terminals are hermetically sealed by exclusive process developed for Cannon's widely acclaimed hermetically sealed electric connectors.
Insulation test: 1000v ac
The armature (plunger) and the anvil are high quality annealed Armco magnetic ingot iron.
Molded Nylon cap protects the terminals.
Molded "Silcan" cap protects the return spring and plunger end.
Silver brazed seals

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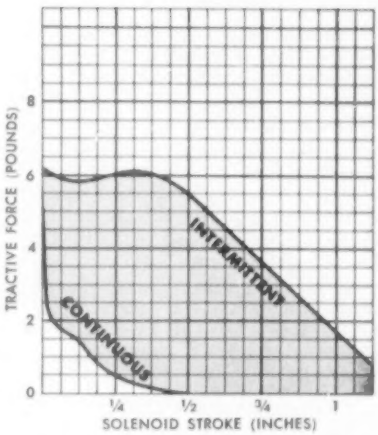
CANNON *dc* SOLENOID

For pressurized or corrosion resistant service, Cannon's dc Solenoids offer positive hermetic sealing, sound construction, painstaking workmanship and highest quality materials. A vitreous insulating material is heat-fused to shell and contact terminals, creating a perfect seal. Other parts are silver brazed. The entire solenoid is then copper-nickel-chrome plated to insure complete coverage, high corrosion resistance and long, trouble-free service. Solenoid No. 19760, above, the first hermetically sealed product of this type, is built for continuous duty on 28v dc systems. Fitted with other coils, it renders intermittent duty as characterized by the chart at right. Cannon's hermetically sealed solenoid series reflects the same uncompromising attention to details of sound design, engineering and workmanship that has made the name "Cannon" synonymous with "quality" for more than 38 years. For complete information write for new Solenoid Bulletin DCS4-1953 showing 105 different assemblies.



Solenoids of the hermetically sealed 19760 series, through modification of the coil windings, can meet various characteristics and specific applications within the limits indicated above.

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Industry Gets Microstrip License Offer

• IT&T makes available new process of forming small, lightweight, low-cost microwave accessories.

By Philip Klass

The electronic components and equipment industry has reacted swiftly to an offer by International Telephone & Telegraph Corp. to license its new Microstrip process, a printed circuit technique for making extremely small, lightweight, low-cost waveguides and accessories for use in radar and microwave equipment (AVIATION WEEK Feb. 2, p. 46).

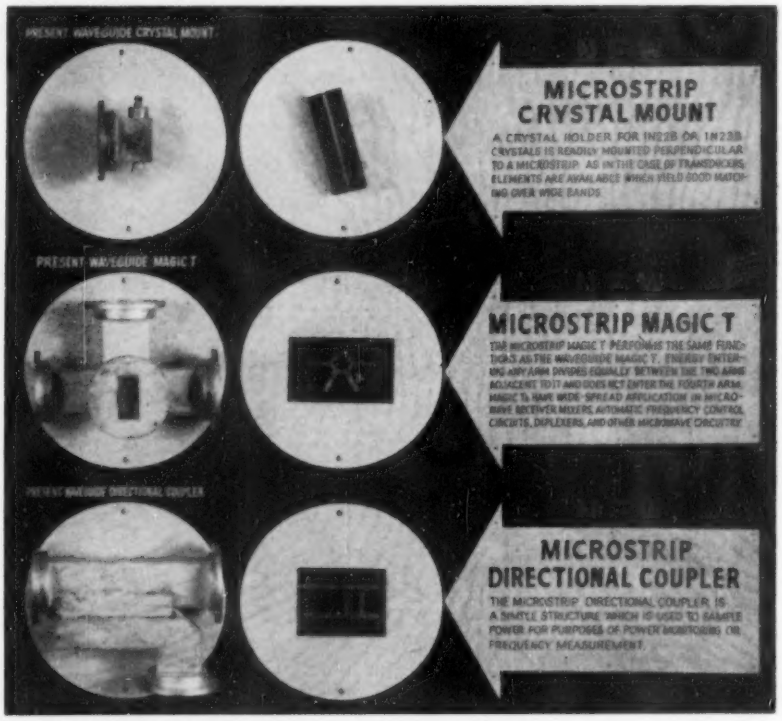
Less than a week after the license offer was made at a technical Microstrip symposium, more than half a dozen companies had opened negotiations, an IT&T spokesman reports. The symposium was held at IT&T's Federal Telecommunications Lab, Nutley, N. J., which developed the process.

Five of the companies are currently in the waveguide or printed circuit business. Two others are equipment manufacturers who want to subcontract the waveguide engineering portions of their new military developments to FTL for application of the Microstrip technique.

▶ **Licensing Offer**—A hundred engineers, representing 60 different electronic equipment, component, and aircraft manufacturers, attended the symposium for a technical briefing on Microstrip. They learned that IT&T now has 30 patents and applications pending on Microstrip. These, plus FTL know-how gained in three years of work, were offered to companies interested in signing a license agreement with ITT.

Microstrip is expected to have considerable appeal for use in aircraft and missiles, where its size, weight, and (for missiles) its low cost, offer attractive advantages. IT&T spokesmen frankly admit, however, that the technique has disadvantages for certain applications and they don't expect it to completely replace conventional microwave plumbing.

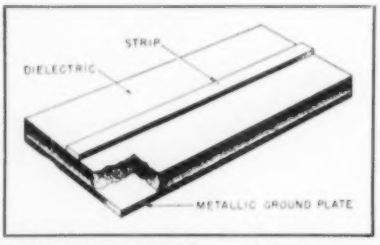
▶ **Construction Details**—Microstrip performs the function of a conventional waveguide which serves to carry microwave energy from a radar magnetron to the antenna, and from the antenna to the intermediate frequency stage of the receiver.


PRESENT WAVEGUIDE CRYSTAL MOUNT
MICROSTRIP CRYSTAL MOUNT
A CRYSTAL HOLDER FOR 1N23B OR 1N23B CRYSTALS IS READILY MOUNTED PERPENDICULAR TO A MICROSTRIP. AS IN THE CASE OF TRANSDUCERS, ELEMENTS ARE AVAILABLE WHICH YIELD GOOD MATCHING OVER WIDE BANDS.
PRESENT WAVEGUIDE MAGIC T
MICROSTRIP MAGIC T
THE MICROSTRIP MAGIC T PERFORMS THE SAME FUNCTIONS AS THE WAVEGUIDE MAGIC T. ENERGY ENTERING ANY ARM DIVIDES EQUALLY BETWEEN THE TWO ARMS ADJACENT TO IT AND DOES NOT ENTER THE FOURTH ARM. MAGIC T'S HAVE WIDE SPREAD APPLICATION IN MICROWAVE MIXERS, AUTOMATIC FREQUENCY CONTROL CIRCUITS, DIPLEXERS, AND OTHER MICROWAVE CIRCUITRY.
PRESENT WAVEGUIDE DIRECTIONAL COUPLER
MICROSTRIP DIRECTIONAL COUPLER
THE MICROSTRIP DIRECTIONAL COUPLER IS A SIMPLE STRUCTURE WHICH IS USED TO SAMPLE POWER FOR PURPOSES OF POWER MONITORING OR FREQUENCY MEASUREMENT.

CONVENTIONAL WAVEGUIDE and microwave accessories are compared with Microstrip versions, shown on demonstration board at IT&T's recent industry symposium.

Conventional waveguide construction, consisting of rectangular thin-walled metal tubing, is aptly called "plumbing." It is comparatively difficult and costly to fabricate and form to required tolerances.

Microstrip substitutes an open type of waveguide, consisting of a thin copper conductor separated from a copper sheet (ground plane) by a thin dielectric. In this technique, waveguides and components, (such as hybrid junctions and attenuators) once designed, are drawn to scale on a tracing cloth, photographed, and then produced by a photoetching process similar to that used for conventional printed circuits.



BASIC MICROSTRIP consists of copper conductor separated from a copper ground plane by a thin dielectric (non-conductor). The unit is produced by a photo-etching process.

As a result, FTL says its Microstrip waveguides and components can be produced for only "a few percent" of the cost of conventional microwave plumbing.

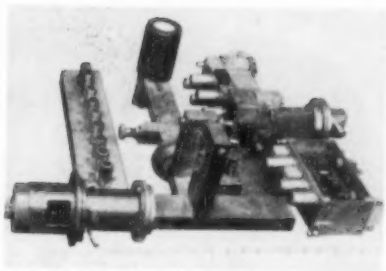
▶ **Other Advantages**—In addition to low cost, the symposium heard H. F. Engelmann, head of FTL's Microstrip engineering group, cite the following advantages:

• **Lightweight:** It has a 25-100:1 weight advantage over conventional plumbing. The weight saving advantage decreases as operating frequency increases.

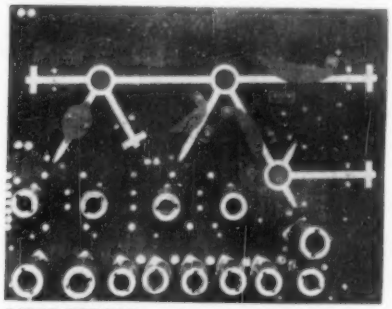
• **G-resistant:** Its low mass makes it attractive for aircraft and missile use where equipment is subjected to very high G-loading.

• **More compact:** Its construction reduces overall equipment size.

• **Eases moisture problem:** Bonding between copper conductors and dielectric keeps out moisture and eliminates seal-



MICROWAVE RECEIVER, constructed with conventional waveguides and techniques, look like this in . . .



MICROSTRIP version of same unit.

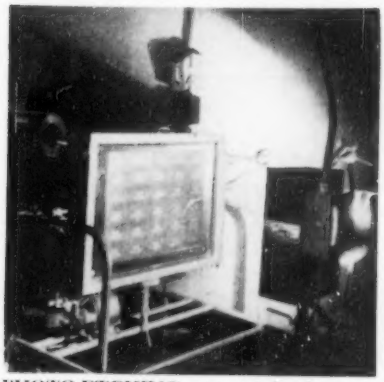


PHOTO-ETCHING process is used to produce Microstrip. Here a photo negative of a group of hybrid junctions is being exposed for a "contact printing" on a photo-sensitized copper plate.

ing or desiccating problems associated with conventional waveguides.

• **Easy to work:** Open construction makes it easier to work, both in production and in the laboratory. In experimental designs, a pen-knife can be used to form copper waveguide conductor.

• **Quick transition:** The transition from experimental waveguide to production is speeded with Microstrip because the experimental waveguide need only be photographed to provide a master pattern for production.

▶ **Disadvantages**—Principal disadvantage of Microstrip is its greater losses, particularly at the higher microwave frequencies used in avionic applications. This higher attenuation is inherent in this type construction, although improved dielectrics may eventually ease the problem. (Teflon-fibrous glass, with a dielectric constant of 2.60 at 1 mc., is presently used.)

Engelmann told the symposium audience that Microstrip performance is roughly comparable to Type RG-8/U coaxial cable. "If your equipment can use RG-8/U, it can use Microstrip," Engelmann said.

▶ **Compensations and Limitations**—FTL has found that higher losses (per running foot) do not necessarily mean decreased equipment performance in many instances, A. G. Clavier, FTL technical director, reported. Reason is that Microstrip permits more compact equipment layout and construction, requiring less waveguide than when conventional plumbing is used.

Although the new techniques can be used to form hybrid circuits, attenuators, local oscillator mounts, and crystal holders, they are not suited for high-Q (capacitance) circuitry, both Clavier and Engelmann emphasize. This includes such items as cavity resonators and filters where low losses are mandatory.

Microstrip has more limited power-handling capabilities than conventional plumbing. Engelmann reported that it can safely handle 100 watts CW (continuous wave) at a frequency of 10 kmc., but he noted that FTL has run Microstrip at 400 watts at that frequency. At lower frequencies, the CW power handling capabilities of the device are higher.

Most of FTL's work with Microstrip has been in the 5-kmc. band, although it has been tested at least to 10 kmc.

▶ **Demonstrating Microstrip**—Dynamic exhibits, designed to demonstrate the performance of Microstrip components, were placed around the symposium auditorium and attracted considerable interest. One, for example, had a Microstrip waveguide with ferrite attached to its ground plane. A small magnetic pick-off, excited from an audio oscillator and placed on the waveguide, served to modulate the microwave energy from another signal generator which was passing through the waveguide.

FTL has devised and plans to sell an "Erector-set" type of kit of standard Microstrip lines and accessories. These can be quickly connected into a variety of microwave circuits for engineering experimentation and familiarization. Price of the kit will be $350-500, depending on its contents, a spokesman says.

Slotted sections, normally employed for microwave component impedance measurement, are difficult to use with Microstrip. For this reason, FTL has developed new analytical and measurement techniques and tools, including a hyperbolic protractor, whose use was described by George Deschamps, who developed them.

New Developments In Mag Amplifiers

New developments in magnetic amplifiers, which are finding increased use in avionic equipment, particularly servo systems, have been announced recently by three manufacturers. The companies and their products are:

• **Magnetic Research Corp.** has announced three different types of 400-cycle mag amplifiers. Model MA-3.5-400 delivers 3.5 watts, 115 v. and is designed for servo motors such as U. S. Navy Model Mk.14. Unit weighs 12 oz., will operate at an ambient temperatures up to 105C and has a frequency response of 0 to 55 cps., company says. Model MA-15-400 mag amplifier has similar specs but is rated for 15-watt output. Model MA-40-400 delivers 40 watts at 220 v. and is designed for use with servo motors such as Eclipse-Fioneer CK3001. This model weighs 4 lb., can be operated at 75C, and has a frequency response of 0-10 cps., manufacturer says. All models are controlled by a 12AU7 vacuum tube which serves as a demodulator when an a.c. input signal is used. Mag amplifier output is a sinusoidal 400 cps. phase-reversing voltage. (Magnetic Research Corp., Dept. HW, 318 Kansas St., El Segundo, Calif.)

• **D. & R. Ltd.** has added a new line of miniaturized 2,000 and 4,000 cps. magnetic amplifiers to its standard line of 60 and 400 cycle units. Model MA-48 in the new high frequency line weighs only three ounces and delivers 25 watts output with rapid response time and high power gain, company says. (D & R Ltd., 402 E. Gutierrez St., Santa Barbara, Calif.)

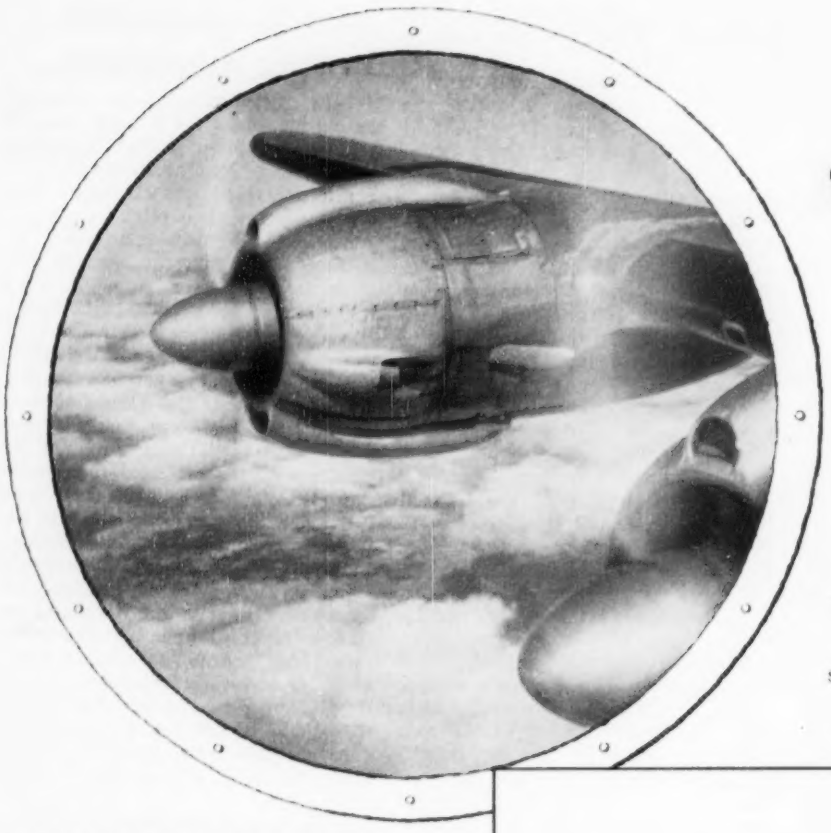
• **Magnetic Amplifiers, Inc.** have disclosed a new line of adjustable mag amplifiers for use in servo systems. Amplifier characteristics can be varied to stabilize servo loop for a wide range of performance requirements, load conditions and gear ratios, company says. (Magnetic Amplifiers, Inc., 632 Tinton Ave., New York 55, N. Y.)

Low Maintenance for Frequency Converter

Georator Corp. has introduced a compact motor-generator unit for converting 60 cycles to 400 cycles.

Featuring "no-brush" construction, the unit boasts of long life and durability with little or no maintenance necessary. It is said to be immune to damage from short circuit or overload and free from radio interference.

Outputs of 150 va. to 25 kva. single- or three-phase are available with motor drive for any standard frequency or voltage. Address: Manassas, Va.



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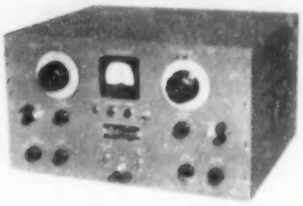
New Devices for Electronic Labs

A variety of electronic lab equipment, ranging from pulse generators to power supplies, from microwave oscillators to rejection filters, has recently been announced.

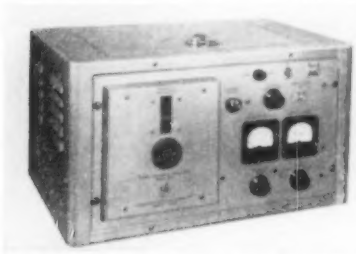
Among the new devices:

• **Pulse Generator,** Model PG-200A, for generating rectangular waveforms with pulse widths adjustable between 0.05 to 50 microseconds, (or up to 1,000 microseconds with an auxiliary unit) with rise and decay times of 0.03 microseconds or less, is available from Tele-



tronics Laboratory, Inc. Pulse repetition rate can be varied from one to 20,000 pulses per second. Device may be operated self-synchronous or driven by an external signal of almost any waveform, manufacturer says. Address: 54 Kinkel St., Westbury, L. I., N. Y. (Dept. AW).

• **Microwave Oscillator,** Model 803, designed to serve as a highly stable local oscillator over the frequency range of 2,700 to 2,950 mc., has been announced by Laboratory for Electronics, Inc. Stabilizing monitor loop, operating from a calibrated reference cavity, holds



long-term drift to less than 100 kc., company says. Twenty-five percent modulation can be obtained when oscillator is stabilized; pulse modulation is possible by removing stabilization. Output power is 15 mw. Address: 75 Pitts St., Boston 14, Mass.

• **Large Screen Oscilloscope,** Model 21A, equipped with a 21-inch rectangular direct-view tube to permit more accurate lab measurements or for demonstration purposes, is now available from Technomatic Instrument Co. Stable deflection amplifiers and power supply make it possible to calibrate gain controls for accurate voltage measure-

XLO

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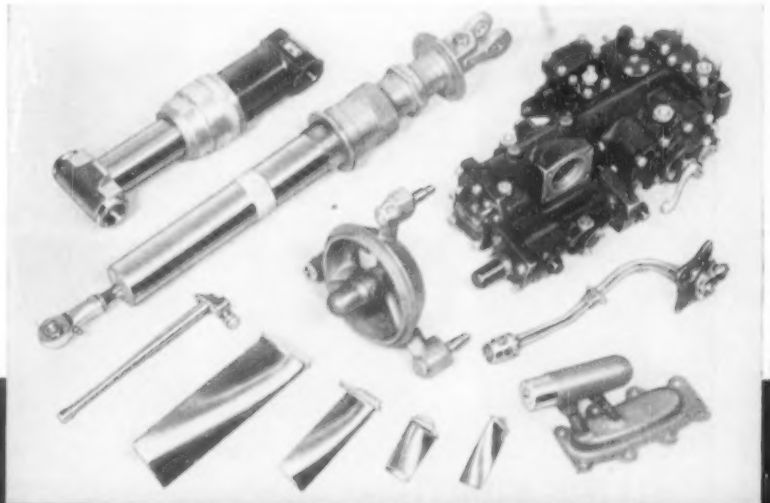

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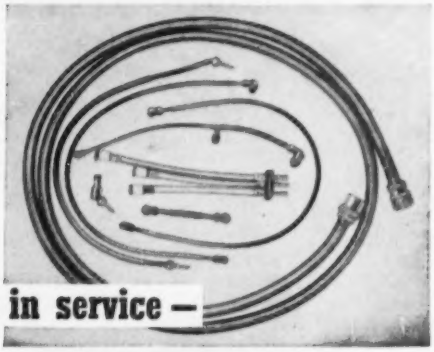

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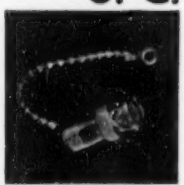
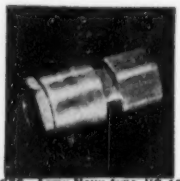
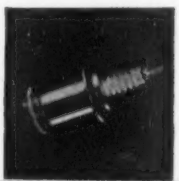


AI-11039, type BNC resistive termination plug. Weatherproof. Styrene Copolymer insert. Neoprene rubber gasket. Can be furnished with any desired impedance.

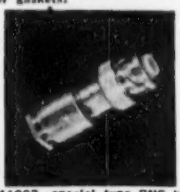
AI-11072, Army-Navy type UG-21D/U, improved type N plug for use with RG-8, 9, 9A, 10/U cables. Weatherproof. Teflon insert, neoprene mating seal gasket, silicon rubber cable clamp gasket.



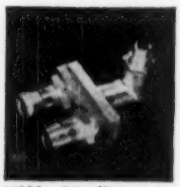
AI-11070, Army-Navy type UG-154/U, type LC plug for use with RG-17, 18/U cables. Weatherproof. Silicon rubber gaskets.



AI-11032, Army-Navy type UG-57A/U, high voltage pulse receptacle pressurized. Ceramic insert, neoprene rubber gaskets.



AI-11022, special type BNC high voltage plug. Mates only with high voltage receptacles and jacks, for use with RG-59/U cable. Weatherproof. Teflon insert. Neoprene rubber gaskets.

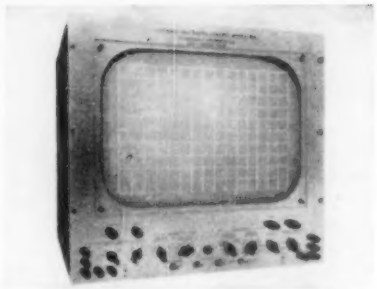


AI-11006, Army-Navy type UG-355/U Klystron Coupler. Weatherproof. Styrene Copolymer and linen base bakelite inserts. For use with klystron tube 726C.

AI-11030, Army-Navy type UG-306/U, type BNC right angle adapter. One male, one female end. Weatherproof. Teflon inserts. Neoprene rubber gasket.

ALLIED INDUSTRIES, INC.

1023 S. 21st Street
Louisville 10, Ky.
Phone Arlington 4640



ment, company says. Maximum deflection sensitivity is 10 mv. (peak-to-peak) per inch. Address: 2316 Pico Blvd., Santa Monica, Calif.

FILTER CENTER

► **New Radar Display Tube**—Airline search for a high-intensity cathode ray tube suitable for use in airborne surveillance radar may be over. Radio Corp. of America's research lab has developed a new storage-type CRT which has line-by-line erasure as well as half-tone (shaded) reproduction. Both features are desirable for weather radar display.

► **Bell Helicopter Autopilot**—Bell Aircraft Co. has developed and is now testing an automatic pilot for use on its HSL-1 anti-sub helicopters, the company says. Device is intended to improve HSL's all-weather capabilities.

► **Avionics Literature**—Recently announced publications of interest to persons in the avionics field include the following:

• **Packaged plug-in circuits**, available in a new type of construction which permits disassembly for access to individual components, is described in a 12-page brochure available from T. E. Coalson of Electronic Engineering Co. of Calif. Brochure describes 20 off-the-shelf plug-in circuits and 26 types available on special order. Address: 180 S. Alvarado St., Los Angeles 57, Calif.

• **Hermetic-sealed transistors**, point-contact types, are described including performance and application data in Bulletin No. DL-S 312 available from Texas Instruments Inc., 6000 Lemmon Ave., Dallas 9, Tex.

• **Accelerometer**, Model A105, designed to measure accelerations of 5 to 5,000G, at frequencies of 3 to 3,000 cps., at temperatures up to 900C, is described in bulletin by Gulton Mfg. Corp. Transducer weighs 2 oz. and uses a piezoelectric ceramic strain gage. Company address is: Metuchen, N. J.

• **Avionic components**, ranging from subminiature capacitors to mass fuel flowmeters, from aircraft generators to jet engine thermocouples, are described in a new 20-page booklet, GEA-5972, showing General Electric's line of aircraft components. Booklet also describes afterburner fuel pumps and new air turbine drives. Copies are available from GE's Apparatus Sales Division, Schenectady 5, N. Y. —PK

NEW AVIATION PRODUCTS

Actuators Redesigned For High Temperatures

Bendix Aviation Corp.'s Pacific Division announces redesign of the Geneva-Loc electric actuators to fit them for high-temperature use.

The company states that both the LM 108 and LM 118 series now operate under full-load at temperatures in excess of 250F. Armature and file assemblies are designed for temperatures over 450F.

With proper consideration for radiation, circulation and other factors, actuators can be used around 500-600F, the manufacturer says.

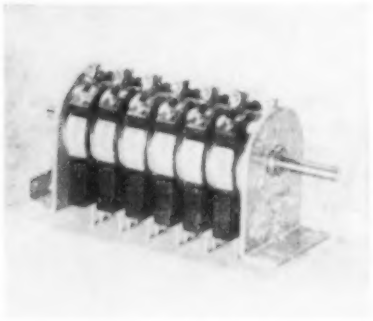
Units are positive mechanical positioning actuators. Cam movement accomplishes positioning while motor does the work. Special insulating material and new bearings have been incorporated into the new designs.

Bendix Aviation Corp., Pacific Division, 11600 Sherman Way, North Hollywood, Calif.

Fire Control Equipment Plugs Into Potentiometer

Fairchild Camera and Instrument Corp. announces redesign of its type 746 potentiometer to incorporate a "plug-in" feature for aircraft fire control equipment.

Only end plates are fastened on the new P-746, permitting quick and easy mounting. There are no wires to con-



nect or solder. Quick checking is possible because of accessible check points. Manufacturer states that up to 20 units can be ganged on a single shaft, giving maximum rigidity. No couplings are used.

Overall resistance range is from 85 to 115,000 ohms for linear windings. Resistance tolerance is ±3%. Nominal effective electrical angle is 320 deg. with linearity of ±0.5% and conformity of ±1% or better. Starting torque is 1.5 oz. in. per cup section.

Tolerances include a concentricity of shaft to pilot bushing of 0.001 in. FIR maximum, radial shaft play of 0.0009 in. maximum, pilot bushing diameter of 0.5 in. (+0,-.0005 in.). Stainless steel shaft is centerless ground to a diameter of 0.25 in. (+.0000,-.0005 in.). Shaft may extend both ends of gang with standard front extension of 0.75 in. (±.031 in.). Operating ambient temperature range is minus 55C. to 71C.

Fairchild Camera and Instrument Corp., 225 Park Ave., Hicksville, L. I., N. Y.

ADF Tuner Control Unit Permits Remote Mounting

A small, compact remote ADF (automatic direction finder) tuner control, measuring 4⅞ in. by 4½ in. across its face, is being offered by Lear, Inc.'s LearCal division to go with the tuner unit of the company's standard ADF-14 automatic direction finder.

Its frequency selector covers three bands—195-400 kc, 475-1,050 kc, and 1,000-1,750 kc,—and functions through a flexible cable. The unit has an illuminated shutter-type dial. It also has vernier tuning control, a volume control, function selector switch, CW switch and tuning meter. It is designed for simplicity in cockpit use.

LearCal notes that unit will be available only as part of complete ADF-14 system for the present.

Lear, Inc., LearCal Div., 11916 W. Pico Blvd., Los Angeles 64, Calif.

Northrop Awards License For Leakproof Fitting

Peerless Machine Co. has received an exclusive license from Northrop Aircraft, Inc., to manufacture and market a Northrop-developed leak-proof, freely rotating, swivel elbow fitting for jet aircraft fuel systems, originally designed for use on the F-89 Scorpion all-weather interceptor.

Northrop says the unit is capable of withstanding heavy loads exerted by high-pressure fluid flow, rotates easily through 360 deg.

Peerless Manufacturing Co., 5338 Alhambra Ave., Los Angeles 32.

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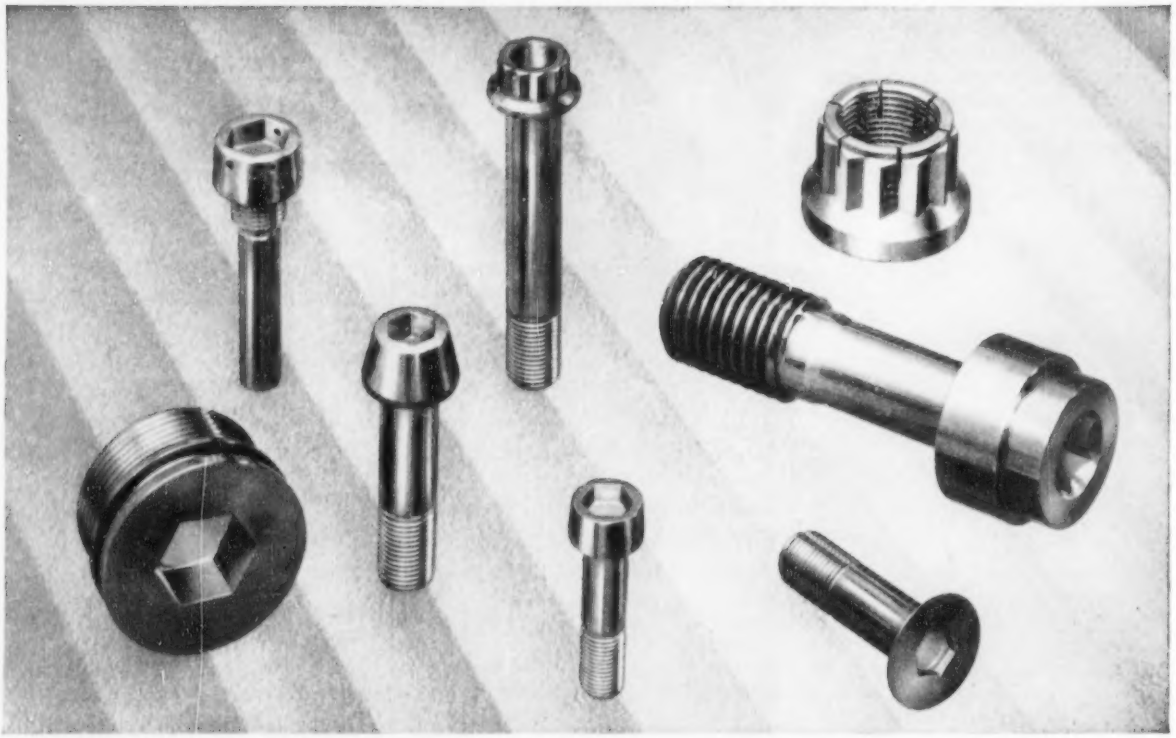

A typical selection of SPS Fasteners. For information, write STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

AIRCRAFT PRODUCTS DIVISION

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Our Fiftieth Year : A START FOR THE FUTURE

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To protect its new fleet of million-dollar Douglas DC-6B's, Western has specified that all of them will carry fire-resistant Monsanto Skydrol* in the cabin superchargers. These new planes are for service on the Pacific Coast, and between California and Minnesota.

Western is the 15th major airline to adopt this safe, noncorrosive hydraulic fluid which is unique in its field.

Here's a digest of Skydrol's outstanding performance features:

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SKYDROL...
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Skydrol is the only fire-resistant fluid which can be used in both cabin supercharger and hydraulic systems, as well as oleo struts. Ask for information on Monsanto's Pydraul* F-9, fire-resistant fluid for hydraulically operated industrial equipment.

THIS BOOK, containing complete Skydrol specifications and test data, will be sent to airline officials or aircraft owners on request. Write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.

North American Aviation

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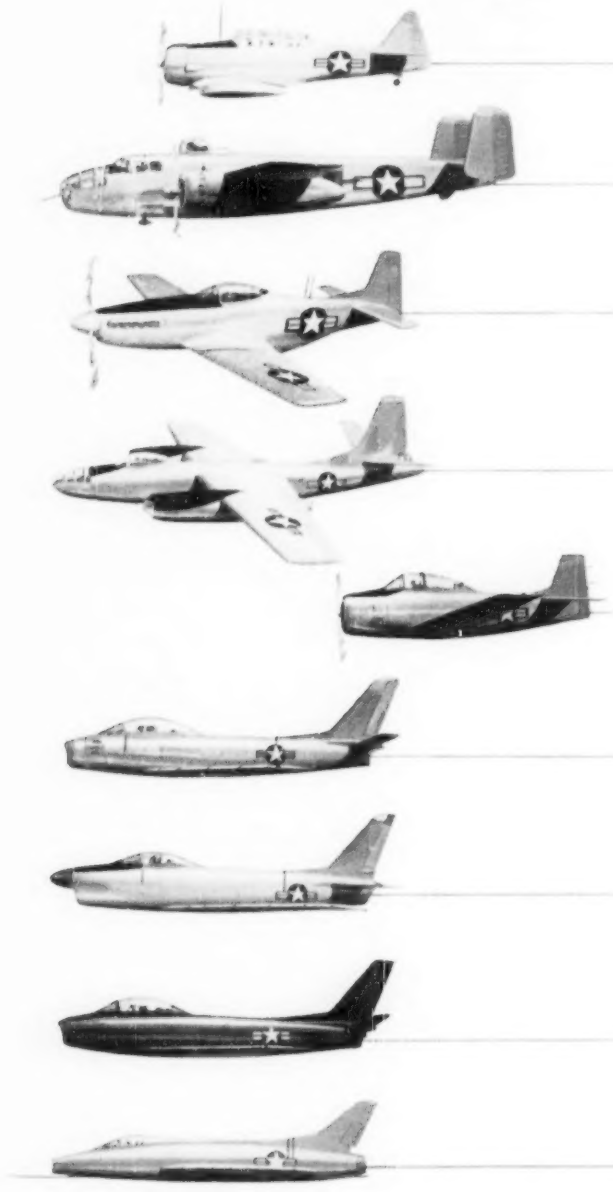

T-6 Advanced Trainer – Used by 33 Allied Nations in W. W. II. Provided close tactical ground support in Korea.

B-25 Mitchell Bomber – Served in all theaters in W. W. II in several different bombing capacities... including famous first bombing of Japan. Rugged, practical, heavily armed.

P-51 Mustang – Leading fighter of W. W. II. Served as photographer, dive bomber, strafer, escort, spotter, for close ground support. Held line in Korea before *Sabres* arrived.

B-45 Tornado – First operational multi-jet airplane to fly in the U. S. First to fly non-stop across the Pacific.

T-28 Trainer – Faster than many W. W. II fighters with top speed of 346 MPH. 1,000 already delivered to Air Force. Now being delivered to Navy.

F-86 *Sabre* Jet – News making king of MiG Alley with kill ratio of 12 to 1 over MiGs. Produced in Australia and Canada and in Italy for NATO. Acclaimed as best all 'round fighter in the world.

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FJ-3 Fury Jet – Latest of North American's FJ Series of Navy carrier-based fighters. With faster speed and rate of climb and superior firepower.

F-100 *Super Sabre* – Tri-sonic performance with overall weapon effectiveness. Now in production for Air Force. Flies faster than speed of sound in level flight.

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD

New Charts Simplify Highspeed Navigation

- **Coast & Geodetic strips clutter from air maps.**
- **Simpler, safer series stresses major hazards.**

By Lee Moore

A new family of aeronautical charts designed to simplify highspeed jet and transport navigation, as well as lightplane visual flying, will be introduced by Coast & Geodetic Survey this winter and next spring.

The experimental charts are extensive modifications of the conventional route, radio facility, approach and landing, and standard aeronautical chart series.

Here are the schedules for trial and later public sale of the four new chart groups:

• **Jet charts** for highspeed navigation will obviate switching maps on many long flights and eliminate unnecessary details. Four charts covering the entire U. S. will be issued early next year. By June, experimental strip maps, each covering an entire route, will be tried by civil and military operators.

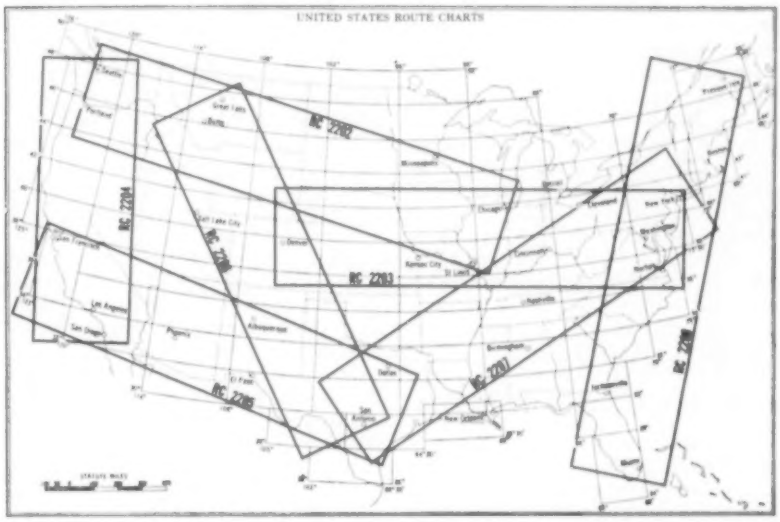
• **Radio facility charts** used for en-route instrument navigation will be changed and reduced from 172 separate charts to from 14 to 18 larger folding charts.

Reaction of users to experimental versions is "favorable," says Cmdr. Edward McCarthy, chief of the Survey's aeronautical chart branch. They probably will be issued early next year, depending upon final results of the current investigation.

• **Aeronautical charts** used by all pilots will be simplified. They will eliminate much detailed instrument information and clutter and emphasize physical hazards such as television antennae. Trial introduction starts early next month. Later pictorial shading of mountains also may be tried.

• **Approach and landing** charts for about 60 airports in hazardous terrain will emphasize contours with pictorial shading. Introduction will be slow because of design and production problems. Only three have been issued to date.

Present complete series of about 1,000 individual approach charts would increase to 1,200 at the current rate. It may be cut to about 400 to 500 by using only one chart per airport instead of one per individual instrument approach to each airport. Trial introduction of this starts in January.



EXPERIMENTAL strip maps are designed for jet flight, each covering an entire route.

▶ **Simpler, Safer**—Early next month, Coast & Geodetic will make a trial issue of its New York sectional aeronautical chart of the type generally used for visual flight navigation.

Cmdr. McCarthy says this series had become more and more complicated by presentation of both high-frequency and low-frequency navigation and information.

The plan now is to strip it back to the major topographic features, give more stress to major hazards and landmarks, cut the instrument information to a minimum, and remove clutter. Changes include:

• **Shorten range legs.**

• **Remove airway borders,** leaving only a light tint to indicate airways.

• **Darken control zones,** calling more attention to positive traffic control.

• **Dramatize TV towers** more than 500 ft. high by use of bold, solid triangle to indicate them.

• **Mark more major airports** with bold shading crossed by actual runway pattern in white.

• **Drop radio frequencies** other than the basic one which is used at each facility.

Some lightplane fliers relying upon detailed visual checkpoints complained as Coast & Geodetic eliminated certain details from the sectional charts.

However, Cmdr. McCarthy says that wherever some detail has been removed, it has been replaced by one considered more useful. He says the government relies upon fliers' cooperation in reporting important new features such as outdoor movie arenas and grain elevators for addition to these charts.

McCarthy sums up the problem: "The trouble is that we continue to get faster planes and new navigation aids but we never get rid of the old ones, complicating the mapping job."

▶ **Jet Navigation**—As aircraft speeds increase, Coast & Geodetic issues simpler, bigger maps to supplement the standard "world aeronautical chart" series used for medium-speed, long-range navigation.

From 1947 to 1950, a route chart series of seven maps evolved. A newer series of four U. S. area charts plus several specialized route charts is being developed for 1954 inauguration. These route charts previously were bare of detail, but military and civil users asked and will get more terrain and radio information. Some of the terrain markings will be designed to aid radar interpretation.

Release of this series awaits agreement between military and civil users on certain requirements.

The program of chart design for automatic DME-VOR pictorial computers has been shelved pending military-civil settlement of the DME electronics dispute (AVIATION WEEK Nov. 28, p. 18).

▶ **Approach & Landing**—As with the RF series, the number of separate approach and landing charts has be-

come nearly unmanageable (more than 1,000 for the U. S.). Coast & Geodetic hopes to be able to cut this number by two-thirds by showing all approaches to each airport on a single chart.

The program of highlighting hazardous terrain by pictorial shading is progressing slowly because it is done by photographing plaster molds. Resultant pictorial presentation of mountain shapes depends upon how they are illuminated during the actual photographing.

A problem with two-color presentation used on approach and landing charts is that if the chart is looked at upside down, shaded mountain slopes sometimes seem to "invert" and appear as valleys, due to optical illusion. Coast & Geodetic is experimenting with lighting techniques to help eliminate this problem.

CPA Loses Fight For Air Cargo Route

Toronto—Canada has rejected Canadian Pacific Airlines bid for airfreight routes from Montreal and Toronto to Vancouver, a decision that continued an air cargo monopoly held by government-owned Trans-Canada Air Lines.

The Canadian Air Transport Board turned the case over to the Cabinet for decision earlier this year, because it involved "a major change in policy." The Cabinet decided that transcontinental air cargo competition at the present time would involve costly duplication of services, "leading to a heavier burden on carriers, shippers and taxpayers alike."

Fight for Title

- **North American Airlines battles to keep its name.**
- **Nonsked planning future expansion, eyes DC-7s.**

A spokesman for North American Airlines, the country's largest nonscheduled operator, terms "ridiculous" a Civil Aeronautics Board order that the company change its name. The nonsked says it is going ahead with plans for the future, including discussion of buying DC-7s.

The carrier plans a court appeal from CAB's order (AVIATION WEEK Nov. 16, p. 18) that it drop "American" from its name to prevent unfair competition with American Airlines.

Meanwhile, the company says load factors on the daily New York-Washington coach flights in which it participates—only such service between these points for months—have remained "among the highest in the business," running around 95%.

► **DC-7 Interest**—North American's plans for the DC-7 are not firm, but it has a definite interest and feels the newest Douglas transport "probably will be the next order."

Presumably this, like two DC-6Bs it is to acquire next year, would be equipped with rearward-facing seats.

Three of the six DC-4s the line operates have been converted to this seating, and passenger reaction reportedly is good. All of North American's planes are to have rear-facing seats eventually. No other commercial service, the company says, uses them.

The DC-6s have been scheduled for delivery late next year, but the carrier hopes easing of military requirements will permit them to be ready by the beginning of next summer.

► **Daily Coach**—North American started the New York-Washington roundtrip flights last summer as a leg of its route from the East to Dallas, Los Angeles and San Francisco.

The service started with a frequency of four days a week, increased to five, and now operates seven. Fare between the two points is $10 one way, $19 roundtrip. Comparative first-class fares on the scheduled carriers are $16.56 and $31.51.

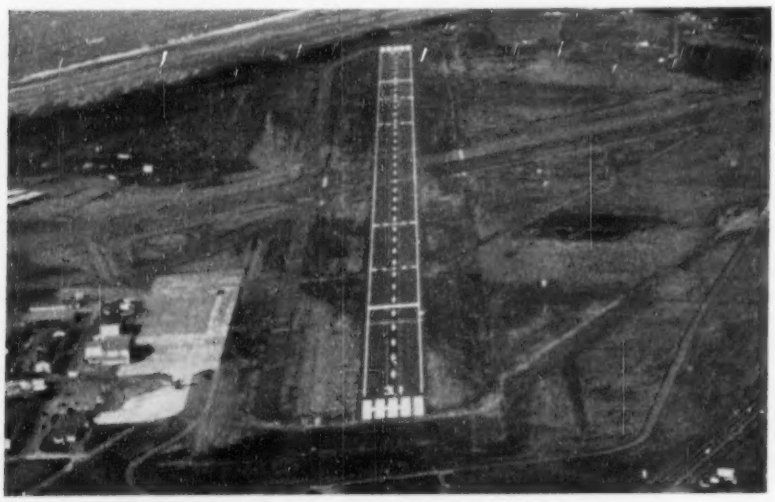
One explanation of the high load factor, in addition to the one-a-day aspect, may be the fact that no scheduled airline has New York-Washington coach service, although American, for instance, has been known to put a full-paying standby passenger between the two cities on a coach flight stopping at Washington on a longer coach route.

► **Boston Next?**—Both American and Eastern Air Lines have asked CAB permission to reinstate their suspended Boston-New York-Washington coach operations, and North American, which already has a ticket office in Boston, is waiting to see what they will do before making plans to serve that city.

► **Frequency Question**—CAB has assailed the frequency of the nonsked flights. But North American, as one of the four operators under the overall ticketing agency, North American Aircoach System, Inc., explains them this way:

The nonsked and its three operating affiliates—Trans American Airways, Hemisphere Air Transport and Trans National Airlines—are limited under their interpretation of CAB restrictions to 15 flights a month between two given points. On the New York-Washington operation, the four nonskeds fill out the month with 15 flights apiece.

In addition to the Southwest route, of which the New York-Washington flights are part, the carrier operates transcontinentally from New York through Chicago and Kansas City to the West Coast, between New York and Miami, and a shuttle between San Diego, Los Angeles and San Francisco.



New Runway Centerline Markings

To provide adequate visual guidance during low-visibility approaches, this centerline pattern of 75-ft. diamonds supplemented with bold threshold markings, solid-line edge stripes and horizontal distance markers has been installed at Arcata Airport, Calif. The markings were designed for the former landing aids experimental station by W. H. Levings, director of the Department of Aviation, Humboldt County.

Correction

AVIATION WEEK has been informed that the 2,000 spark plugs which Eastern Air Lines pulled because of electrode breakage, and mentioned in the Oct. 26 edition (p. 64), were not manufactured by AC Sparkplug, as stated in the article.

Bankrupt Cargo Line Asks for Stock Sale

U. S. Airlines, Inc., has asked Securities & Exchange Commission for permission to sell 905,855 five-cent par value shares of common stock for a total price of $90,000 to keep the cargo carrier operating at least until Dec. 15.

The company is under involuntary bankruptcy proceedings filed Sept. 17 in U. S. District Court for the Southern District of Florida, Miami Division.

▶ **Court Control**—The court authorized the airline Oct. 27 to operate until December, provided it could deposit a special fund of $90,000 within 30 days. U. S. had a deficit of $621,000 Nov. 1.

All money accumulated is to be used in the operation of the business and all income will be deposited in a separate account while the airline is under the control of the bankruptcy court.

▶ **Routes at Stake**—In addition to financial difficulties, U. S. Airlines has been directed by Civil Aeronautics Board to show cause why its certificate of necessity and convenience should not be revoked for failure to service its routes. A hearing has not been set.

The airline has been authorized to service 55 cities, flying freight between Minneapolis and Boston south to New Orleans and Miami with routes intersecting at Atlanta, Ga.

Since June 10, 1952, the company has flown military personnel under a CAB temporary exemption order that expires Dec. 1.

▶ **Leased Aircraft**—The airline also is in difficulty over its six aircraft, all C-46s leased from USAF's Air Materiel Command. Air Force asked the Miami District Court for the return of the six C-46s after the carrier became involved in bankruptcy proceedings.

None of the aircraft has been returned to USAF, because the airline hopes to have its lease restored. The court has not yet made a decision.

Of the stock to be offered for sale, 620,000 shares have been committed by: Gearhart & Otis, Inc., underwriters, 50,000; William D. McCoy, 100,000; Paul D. Sheelin & Co., 50,000; Henry Hornblower, Jr., 10,000; Republic Investment Corp., 100,000; Nathan Kohn, 150,000; Everett Parks, 20,000; Lester Scharff, 20,000; and Jay W. Kaufmann & Co., 120,000. The remaining 285,855 shares will be sold on a "best efforts" basis at the market by the underwriter.

▶ **Change in Command**—Since September, U. S. has had a change in command with the resignation of its president, two vice presidents and treasurer. Fred A. Miller resigned as president and director of the company, and Jack E. Gallagher quit as vice president and treasurer.

John W. Hutchinson, former Glenn L. Martin and Northwest Airlines executive and onetime deputy director of National Production Authority, Aircraft Division, has been named president at a salary of $1,000 per month.

Bernard J. Chubet has succeeded Gallagher as vice president and treasurer. He is associated with Gearhart & Otis, the airline underwriters. His salary has not been fixed, but it will not exceed $800 per month, the airline reports.

No successor has yet been named to Col. G. Gordon Moore, who resigned as vice president and director.

▶ **Recurring Losses**—The airline admits its record has been one of recurring losses since 1945, when it began operations. On Dec. 31, 1952, the company reported a loss of $554,699. By May 31, 1953, the net loss was reported as $242,752.

U. S. is undergoing its third bankruptcy proceeding. Financial difficulties sent the company into bankruptcy in June 1951. The firm was reorganized in October of that year, and a recapitalization program pulled the airline out of the red. Involuntary bankruptcy was filed against the carrier in October 1952 by its creditors. This was settled when creditors received their payment.

ALPA Protests Cut In Weather Ships

The Air Line Pilots Assn. has written to Secretary of Commerce Sinclair Weeks protesting the U. S. government's decision to withdraw its support of the North Atlantic weather ship program (AVIATION WEEK Nov. 2, p. 15).

ALPA president C. N. Sayen says the association's primary objection is that the decision was reached without consulting pilots and with no visible effort to find substitutes for the services.

"The men who conduct flights over the North Atlantic routes," he says, "have day-to-day knowledge and experience as to the necessity for such services not available to any other group or organization. We believe we are entitled to be consulted prior to decisions being rendered which affect the facilities available to us to fulfill our responsibilities."

▶ **Government Reply**—Commerce Department and Coast Guard replied that the withdrawal plan was studied thoroughly by Air Coordinating Committee representatives of all interested government agencies. They found that no agency had a "requirement" for the ships, and that the U. S. no longer can afford such weather station services as a "convenience."

ACC then checked with the Air Transport Assn. and the individual airlines flying the Atlantic. All confirmed that there was no actual "need" for the ships, U. S. officials said.

The Weather Bureau plans to substitute a new daily reporting system from ships and aircraft at sea. A search-and-rescue program utilizing more of the en-route facilities also is being prepared.

Conveyers for Airport Travel

Artist's conception of a design by Goodyear Tire & Rubber Co. for conveyer belts to be used at large air terminals for moving passengers and baggage to and from planes. Speedwalk system incorporates moving stairways and belts for luggage, both revolving at the same speed so that passengers can transfer safely from one to the other.

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McGRAW-HILL PUBLICATIONS

Airlines Winning State Support

CAB member Adams starts promotion program by warning officials to aid local carriers or lose them.

State aeronautic and airline officials are showing signs of promoting their federal-subsidized local service air carriers in response to a use-it-or-lose-it challenge by Civil Aeronautics Board member Joseph Adams.

State officials come to Washington to plead with CAB for more federal-supported local service, Adams told the National Association of State Aviation Officials, and then do little to make the service succeed.

Reactions include:

• **Allegheny Airlines president** Leslie O. Barnes: ". . . A most significant milestone . . . your address developed a most sensitive, but nonetheless vital, point of responsibility. Leadership on the question of federal-state-management responsibilities in the development of local service necessarily had to come from the CAB.

"With the greatest sincerity, I congratulate you on again assuming the leadership in the development and enunciation of a basic point of policy. . . . Follow-up depends to a large extent now on the local airlines and on the state organizations."

• **Ozark Air Lines president** Laddie Hamilton said his airline would work with local communities and airports, and stated:

"Your message was a very constructive one in affording the State Aviation Officials a tangible program of assistance to the local service carriers at this important time . . . we have already received a letter from Mr. Lee Lamar, chief of the aviation section in Missouri, offering to assist us in the ways outlined by your address."

• **Central Airlines president** Keith Kahle said: "Your speech should help us in getting over the point that the cities have a responsibility on generating traffic, the same as the local service airline." He added that Central's "competition out here is the private automobile and the bus" and the airline hopes to experiment soon with radically lower fares to obtain more traffic.

• **Piedmont Airlines president** T. H. Davis wrote "to tell you what a great service I think you have rendered to our industry."

• **West Coast Airlines president** Nick Bez said, "I have instructed our people to follow up on this so that the splendid effort you displayed would not be lost, and I am sure some good will come from it."

• **Air Transport Assn.** general counsel Stuart Tipton wrote, "Stan Gewirtz, Ed Rigers and I . . . agreed that it was an excellent presentation and thought that you would probably not regard us as being presumptuous if we told you so."

• **American Airlines vice president** Miss Carlene Roberts called the Adams critique "a helpful guide toward progress in the local airline field."

Counsel Howard Westwood said that "it is one of the most stimulating discussions of this subject I have read in a long time."

• **Vermont** Aeronautics Commission director Edward Knapp said that Adams' presentation "was one of the most stimulating and challenging that has been delivered by a Board member. It establishes a definite relationship and policy in the area of local airline service between state aeronautic agencies and the Board in setting forth responsibility for success of the service."

• **Pennsylvania** aeronautics director John W. Macfarlane praised the Adams challenge but asserted that Pennsylvania already has been doing much work to promote local service airline growth.

▶ **Adams Recommends**—Here is the six-point positive program that Adams recommended to the state aeronautical officials at their annual meeting:

• **To get things started,** "state aeronautical directors should call on the (airline) managements concerned to send their officials to the office of the (state) director for a good indoctrination seminar."

• "**Procure a monthly origin** and destination report of the local service airline serving your communities and proceed from there." Then, Adams recommends, join chambers of commerce and other civic groups in a "use-it-or-lose-it type of campaign" in towns which the survey reveals to be producing less than 150 passengers a month.

• **The state agency** officials "should explain through their publications, radio and TV programs the type of service that the local carrier is rendering and that the continuation of local service is dependent upon full acceptance and support by the communities." The state should "point up the fact that federal subsidy involved in local airline operation is a subsidy to the community, not the carrier. . ."

• **Endorse and encourage** use of local service by all state agencies for official travel.

• **Start "air educational tours."** Adams notes that one state director promoted local airline tours last year "that moved 2,584 people, mostly boys and girls under 15 years of age as part of this program."

• **Boost revenue, cut costs** for the airline by encouraging airport managements to switch their fee collections from a fixed-fee to a percentage-of-revenue basis. This way, the airport and the airline work together toward increasing revenues, and the airline is not faced by fixed charges that, temporarily, it may not be able to afford.

▶ **The Problem**—CAB members and the Commerce Department this year have become increasingly alarmed at the mounting subsidy needs of the locals. Adams, as a former (Washington) state aviation director, had pondered this problem and gathered airline and state information throughout the summer of 1953 before delivering his challenging program to the NASAO.

SHORTLINES

▶ **Air France's** new nonstop "Golden Parisian" Super Constellation flight leaves every Friday from Idlewild Airport for Paris following luxury flight's inauguration Nov. 20. The special flight carries 32 passengers at an extra cost of $25 plus $125 for "Sky Room" accommodations.

▶ **British Overseas Airways Corp.** expects to introduce the Comet 2 on its London-Rio de Janeiro route next June . . . BOAC has applied for permission to operate a once-weekly first-class service, Manchester, England, to New York.

▶ **Canadian Pacific Airlines** expects delivery next fall of three Comet 2s for use on its intercontinental routes from Vancouver to the South Pacific and South America (AVIATION WEEK Aug. 7, p. 84). Cost of the jet transports will be $4.5 million.

▶ **North Central Airlines** carried 10,401 ton-miles of U. S. airmail during October, a new record for NCA. Previous high was 9,953 ton-miles October 1952.

▶ **Northwest Orient Airlines** reports it carried more airfreight to Anchorage, Alaska, from Seattle in the 11 months ended Nov. 11 than it did for the whole year of 1952. Through October, it was running 22% ahead of the same period in 1952 for total airfreight lifted to Alaska. . . . NWA began reduced tourist fares on its Stratocruiser service between the U. S. and the Orient Nov. 15.

▶ **Pan American World Airways** has returned six of its 16 C-54s leased from the Air Force in 1947. The other 10 will be returned shortly as PAA replaces the leased C-54s with DC-6Bs.

▶ **Philippine Air Lines** will increase the number of passengers carried between Madrid and Rome to 25 under a new agreement approved by Italy. PAL serves these cities on its route between London and Manila.

▶ **Port of Oakland** (Calif.) reports the Institute of Transportation and Traffic Engineering of the University of California is investigating the possibility of more economical design of airport runways as a result of tests which were conducted recently at Oakland Municipal Airport.

CAB ORDERS

GRANTED:

Braniff Airways final domestic mail rate at 53 cents a ton-mile, with no subsidy.

Seaboard & Western Airlines exemption to make a passenger flight from Brussels, Belgium, to New York under contract with the Inter-governmental Committee for European Migration.

Trans-Texas Airways authorization to suspend service at Brady, Tex., until airport facilities are improved.

Alaska Airlines pilots permission to intervene in the States-Alaska route case.

New Orleans and its chamber of commerce permission to intervene in removal

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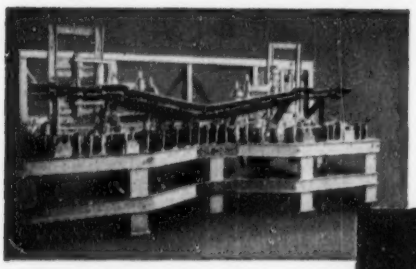

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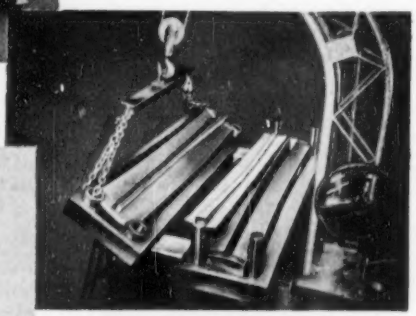

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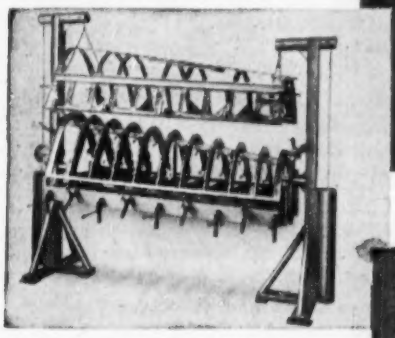

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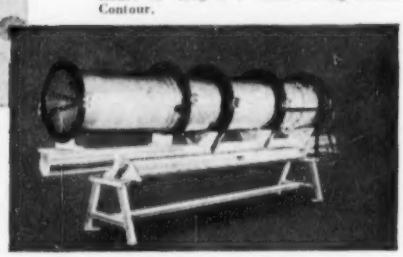

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of TACA International Airlines foreign air carrier permit.

Wheeler Airlines, Ltd. (Canadian) permission to carry out an aerial photography contract on 200 mi. of power lines in Vermont, using Anson aircraft. CAB noted that the Canadian government grants similar reciprocal privileges to U. S. operators.

Kenting Aviation, Ltd., permission to make an airborne magnetometer survey in the U. S. for M. A. Hanna Co., Ltd., using PBY-5A or Anson aircraft.

Northwest Orient Airlines waiver of safety regulation requiring 50 hr. proving tests on new equipment, in this case Douglas DC-6Bs, to inaugurate Seattle-Honolulu aircoach service. Plane is a proven one, and Northwest has years of experience on the route, CAB noted. United Air Lines will conduct Honolulu maintenance on NWA's DC-6Bs under contract.

Wien Alaska Airlines final mail rate of $951,152 for Oct. 24, 1952-June 30, 1953. New rate provides an estimated total of $1,360,583 per year henceforth. Of that total, $1,040,663 is subsidy and $319,920 compensatory for actual mail service.

Cuba Aeropostal permission to start serving Miami International Airport in accordance with foreign air carrier permit.

Joplin, Mo., and Lamar County, Tex., chambers of commerce permission to intervene in Fayetteville, Ark., air service investigation.

APPROVED:

International Air Transport Assn. agreement amending rules on Europe-Africa coach fares.

California Central Airlines contracts with Airline Transport Carriers, Inc., for lease of five Martin 2-0-2s by California Central to ATC Sept. 1, 1953, to Dec. 31, 1954, and for ATC maintenance on CCA planes.

DENIED:

Chicago-Detroit local service requests of North Central and Lake Central Airlines to serve intermediate cities by special exemption. CAB said these requests and suggestions that American Airlines suspend similar local service should be consolidated in a full investigation.

Empresa Guatemalteca de Aviacion (Aviateca) motion to consolidate its application for a foreign air carrier permit with that of TACA.

Hughes Aircraft Co., Bell Aircraft Corp., Radioplane Co., Land-Air, and Lockheed Aircraft Corp. petitions to intervene in the local New Mexico route renewal case of Continental Air Lines. CAB says they filed too late.

Riddle Airlines request for temporary exemption to provide passenger service on its back-haul cargo flights from Puerto Rico to U. S., competitive with Eastern Air Lines and Pan American World Airways. CAB says denial would not place undue burden on Riddle, and the issue requires full hearings before decision.

Delta-C & S Air Lines motion for immediate hearing and consolidation into the New York-Balboa through service route case. Delta proposes Havana-Miami service as another factor in the various U. S.-South America interchange proposals of Pan American, Eastern, Panagra, Braniff and National.

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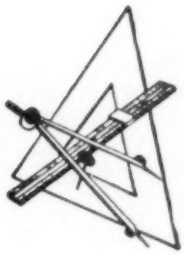

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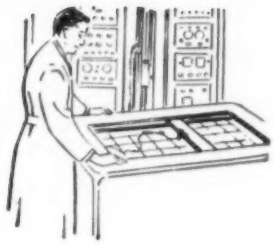

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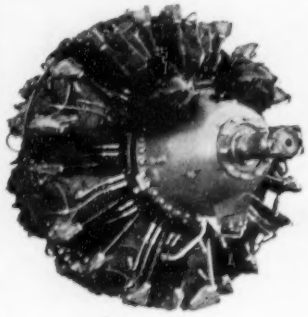

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Bad Weather & Lost Planes

The end of the balmy autumn weather brings us once again to the season of instrument flying conditions with its perennially associated problem of the lost aircraft. This subject is generally considered one of aviation's sacred skeletons—too touchy to mention. But I believe its importance demands exploration.

There are, of course, many reasons why a plane gets lost: instrument or radio failure, severe weather, etc. But these are the extremes, accounting for only a small part of the total and will not be considered here. Of more interest is the "routine bewilderment" case during light instrument conditions. At least one of these occurs per major terminal area with each siege of weather.

Importance of a lost aircraft in a metropolitan area is obvious. At any given instant there may be upwards of 20 scheduled flights with possibly 1,500 passengers, cargo planes and military, commercial and private aircraft. It only takes one bad apple in this barrel.

▶**Dual Problem**—The problem actually is two-fold. First, the long-range view—the problem of making all air navigation and each approach procedure simpler. This deserves greater attention from all who fly or wish to fly. It is hoped that someday progress will be made.

Of more immediate concern, however, is the present. That is, what can be done for this winter or next, recognizing the fact that we have to live with present facilities and methods.

A clue to what can be done comes from those who do **not** get lost. It will be found that pilots who fly with sufficient regularity to be familiar with these complicated areas in properly equipped airplanes have no trouble. So the key word is "qualified," and it relates to both the pilot and to the aircraft equipment.

▶**Wrong Thinking**—Right here, of course, is where the screams get louder and the counter-argument is immediately offered that this type of thinking favors the rich by restricting the rights of the poor. That is rubbish. It is wrong to think that instrument flying is a poor man's game in the first place. And since when is it the custom in this country to drag down the upper level because some refuse to raise their standards?

But safety, after all, is the prime consideration. Regardless of the type of herring dragged across this airway, it simply is not safe to go plowing through today's metropolitan areas without full qualifications to handle the job.

It always has been assumed that possession of an instrument rating permitted a pilot to fly anywhere at anytime. I wonder if this still is a proper premise. For instance, does a "standard" rating obtained in, say, Kansas City insure adequate knowledge to enter LaGuardia on instruments? Or, does knowledge of the New York area qualify a pilot to land at Chicago Midway?

▶**Better Charts**—Admittedly the system is wrong when the answer to these questions is "No." But recognizing this fact doesn't change anything. There still remain about 12 "complicated" areas in the country which require specific knowledge and equipment for safe passage during instrument conditions.

Better aeronautical charts would help (although no one has yet found a way to make them better) and such things as area briefing booklets would be useful. But unless pilots actually have specific "area" ratings (Chicago, New York, etc.) added to their license to show that they have been properly qualified, and unless the aircraft they will fly has the appropriate radio equipment, then lost airplanes will continue to dot the sky in each period of instrument weather.

AVIATION CALENDAR

Nov. 30-Dec. 1—Fifth annual Air Cargo Day, ASME, Hotel Statler, New York.

Nov. 30-Dec. 2—American Society of Mechanical Engineers, annual meeting, Hotel Statler, New York.

Dec. 1-2—ASME's Frequency Response Symposium, Hotel Statler, New York.

Dec. 1-2—Second annual Heavy Press Program, ASME, covering helicopter transmission design features and turbojet components, Hotel Statler, New York. Luncheon honoring engineers' contribution to powered flight by ASME and IAS.

Dec. 3-5—Seventh annual Arizona Aviation Conference, Yuma.

Dec. 7—Civil Aeronautics Board, second session of annual meeting on review of Civil Air Regulations, inter-departmental auditorium, Washington, D. C.

Dec. 8-10—Joint Computer Conference and Exhibition, sponsored by American Institute of Electrical Engineers, American Institute of Radio Engineers, and Association for Computing Machinery, Statler Hotel, Washington, D. C.

Dec. 14-17—50th Anniversary Celebration of Aviation, Kitty Hawk, N. C. Program: Private Fliers and Aviation Pioneers' Day, Dec. 14; Aviation Industries Day, Dec. 15; Defense Day, Dec. 16; Anniversary Day, Dec. 17.

Dec. 17—Seventeenth Wright Brothers Lecture, U. S. Chamber of Commerce building, Washington, D. C. Aero Club Wright Memorial Dinner, Hotel Statler.

Dec. 17—Royal Aero Club dinner commemorating 50th anniversary of powered flight, Dorchester Hotel, London.

Jan. 8-11—Florida Air Pilots Assn., 11th annual air cruise, Miami, Fla.

Jan. 10-12—Institute of Surplus Dealers, trade show and convention, Madison Square Garden, New York.

Jan. 18-22—American Institute of Electrical Engineers, winter meeting, Hotel Statler, New York.

Jan. 20-22—Operations Research in Production and Inventory Control, Case Institute of Technology, Cleveland. Speakers include Paul Stillson of Lockheed Aircraft Military Operations Research Division.

Jan. 25-28—Plant Maintenance & Engineering Show, International Amphitheater, Chicago. Conference will be held concurrently at the Hotel Conrad Hilton.

Jan. 25-29—Institute of the Aeronautical Sciences, 22nd annual meeting, Hotel Astor, New York. Honors Night Dinner Jan. 25.

Feb. 3-5—Society of Plastics Industry, ninth annual division conference on reinforced plastics, Edgewater Beach Hotel, Chicago.

Mar. 22-25—Institute of Radio Engineers, national convention, Waldorf Astoria Hotel and Kingsbridge Armory, New York.

Apr. 5-6—Society of the Plastics Industry (Canada), Inc., 12th annual conference, Mount Royal Hotel, Montreal.

Apr. 29-30—American Society of Tool Engineers, 10th biennial industrial exposition, Convention Center, Philadelphia.

May 5-7—Third International Aviation Trade Show, sponsored by Aircraft Trade Shows, Inc., 71st Regiment Armory, New York.

May 17-20—Basic Materials Exposition and Conference, International Amphitheater, Chicago.

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LETTERS

Action Wanted

I have read your article entitled "NBAA Is Silent on Plane Needs," by Frank Shea, as published in the Nov. 9 AVIATION WEEK.

You quoted me as saying, "There are other organizations besides NBAA and since I have seen nothing constructive accomplished here, I am going to them."

I take exception to this quotation and would like to correct you to this extent: I indicated at the meeting that unless something was done to tell the manufacturers what business flying really needs in the way of equipment, I would do everything possible to form another group outside NBAA, with the express purpose of telling the aircraft manufacturers the needs of corporation flying.

NBAA has done a fine job representing business flying in Washington and I think that the support we give them is well worthwhile, but I also feel that they are falling behind on the basic requirement of aiding in the production of new aircraft, for without this I fear that business flying will decline to the point that no representation in Washington will be necessary.

Anything you can do to help me on the formation of a group of well qualified people on business flying to study the needs of the business aircraft operator, either in or outside NBAA, will be greatly appreciated.

I would like to add one thing more. The requirements I gave for a business aircraft are as follows.

1. Four engines minimum.
2. Minimum speed—400 miles an hour.
3. Pressurized to 25,000 ft. minimum.
4. Range—2000 miles minimum.
5. Size—As small as possible.

A. T. GROVES, Aviation Supervisor
Kimberly Clark Corp.
Neenah, Wis.

(The story referred to was cut in length during editing.—ED.)

Silvaire's Odyssey

On page 55 of the Oct. 12 issue of your outstanding publication, you carried an advertisement for Continental Motors Corp. detailing the flight of Peter Gluckmann from California to London, England, and return in a Luscombe Silvaire equipped with a Continental motor. The advertisement points out that Mr. Gluckmann asked no help from anyone in equipping the plane for the record-breaking flight.

I am sure that statement was an oversight, but Mr. Gluckmann was in constant correspondence with Mr. Merle Mueller, our Chief Engineer, who supplied Mr. Gluckmann with engineering drawings, data, suggestions, and actual equipment for the flight.

As you know, Luscombe Airplane Corp., which built Mr. Gluckmann's plane, is now a part of Temco Aircraft Corp. And although we are no longer producing the Silvaire, we are equally proud of its performance and of Mr. Gluckmann's daring accomplishment. In fact, we have been in contact with Mr. Gluckmann since his return and are working with him on another ocean-hopping flight which he told us he is planning.

We would merely like to join with Continental Motors Corp. in saluting Mr. Gluckmann's accomplishment.

JACK CRADDOCK,
Public Relations, Garland Plant
Temco Aircraft Corp.
Garland, Tex.

Who Helps Engineers?

I am a jet pilot in the Air Force and an ardent reader of AVIATION WEEK. I will soon be released from service and intend to return to college and finish my education in engineering (two years).

In your magazine I noticed the demand for engineers by the large industries and wondered if any of them has a school or plan to help students obtain degrees and possibly work for them part time or on a cooperative plan where their previous experience could be used.

Although none of the firms advertised these schools or assistance, I thought you might know of the companies that do have such schools.

CHARLES A. NEUENDORF, 1st Lt., USAF
3626th Training Group,
Box 558, Tyndall AFB, Fla.

Crowding Airports

Re your news item in AVIATION WEEK Sept. 28 (page 22), entitled "Jet Crash Angers Van Nuys Residents," Gen. Doolittle's comment seems highly pertinent to me. Seems to me that Lockheed, or whoever operates the airport, would be perfectly justified in picketing the residents with signs saying "This community is a menace to the safety of our airport."

If the airport was there first, it seems to me the people who then moved in around it have no kick coming, and can move out again if they don't like it!

DAVID A. STUART
37 Yale Square
Morton, Pa.

Redbird's History

The officers and engineers of the AF Armament Center have thoroughly enjoyed reading your issue of Aug. 17 on the Air Research & Development Command, particularly those portions which concern our own work and fields of interest. I feel, however, that there has been an oversight in the story of the development of a suitable airborne target.

The modification of the A-1 glider target to the sweptwing "Redbird" configuration was a result of the personal efforts of F. A. Miller, a civilian employe in the Fire Control Branch of the Directorate of Test Operations.

It was Mr. Miller who conceived the idea for modification of the standard target. He personally designed the structural changes required by the change in configuration, and working in his spare time, modified the first target. He was in charge of the flight test program which was initiated to evaluate the Redbirds, and flew some 40 missions with them to prove the modification.

The entire Armament Center, and particularly the Fire Control Branch, is extremely proud of Mr. Miller and his Redbirds. We feel that recognition for this excellent piece of work should rightfully be his.

WARD E. PROTSMAN, Capt., USAF
Fire Control Branch, AFAC
Eglin AFB, Fla.

Sabre Fighter-Bomber

A. W. Jessup's article, "F-86F Is Top Fighter-Bomber," in the Oct. 19 AVIATION WEEK is greatly interesting but leaves a misleading impression.

The article suggests that the 18th Fighter-Bomber Wing was the only unit of its kind to "put the Sabre through its fighter-bomber paces" during the final weeks of the Korean War. While the 18th was the first unit to be equipped with the F-86F in the Korean Theater, it was the 8th Fighter-Bomber Group under the command of Col. Walter G. Benz, Jr., which performed the first fighter-bomber mission with the new aircraft, in March 1953.

As a matter of record, the 8th Fighter-Bomber Group consistently flew more sorties than any other wing in Korea with both the F-80 and the F-86F, adding up a total of over 65,000 sorties in the Korean War and pioneering not only the development of fighter-bomber tactics with the F-86F, but also with the F-80s.

A great deal of credit should go to the officers and men of the 8th for their part in ironing out the initial difficulties encountered with the F-86F, and for performing transition to that aircraft from the F-80s without halting combat operations, a feat which the 18th was unable to match.

ROBERT M. WHITAKER
1st Lt., USAF
Dept. of Air Science and Tactics
College of Puget Sound
Tacoma, Wash.

Praise

We at Airwork were most pleased with the article George Christian wrote on our Engine Forum (AVIATION WEEK Oct. 5, p. 64). You are to be commended for your accurate reporting and interesting presentation of the facts.

You would be surprised how many inquiries we have had from all over the country from DC-3 operators who read the article and want to step up performance of their plane. We are planning to send reprints of this article to our complete corporation mailing list.

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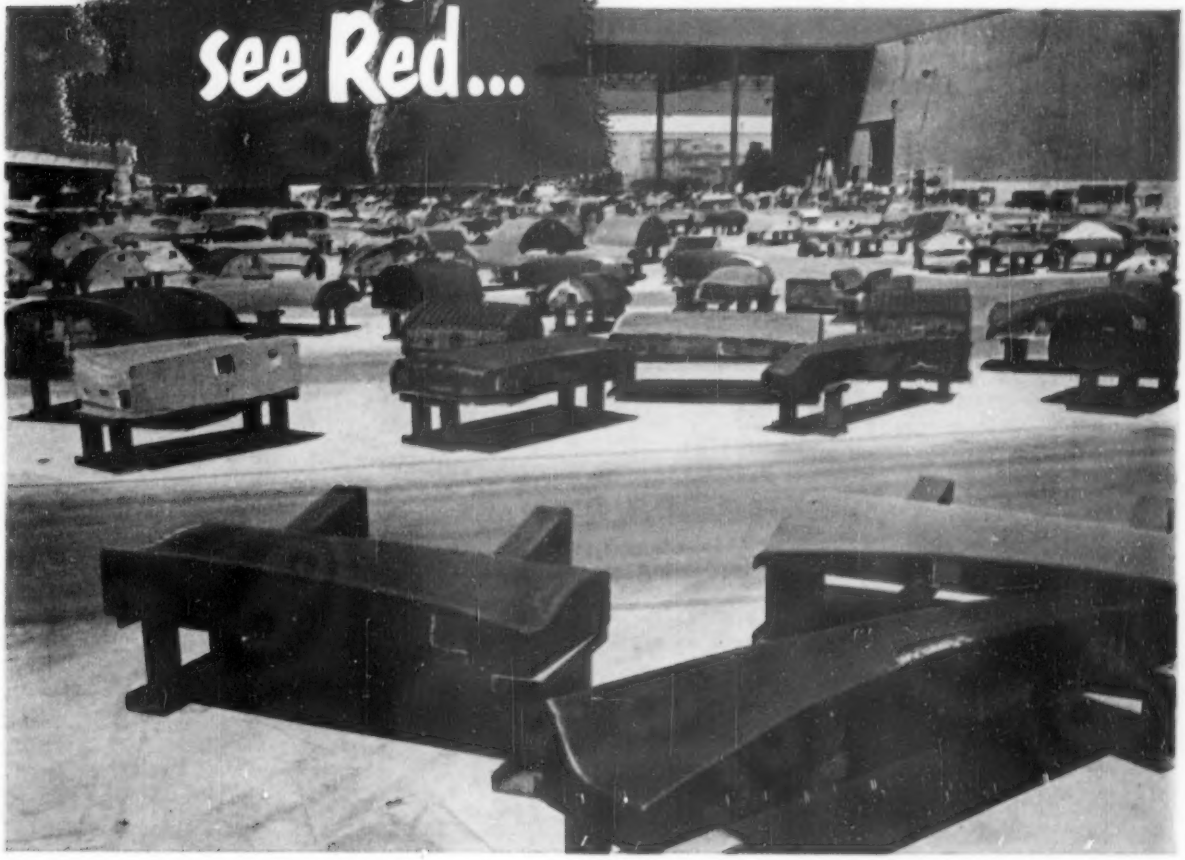

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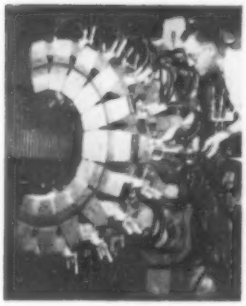
Here is visible proof of HYDRA-CURVE Jaw economy! Each of the stretch-wrap forming dies stored above is color coded. *The red squares indicate those dies upon which sheets are formed directly in the ST condition!* Until the development of HYDRA-CURVE Jaws most sheet parts were stretch-formed in the SO or SW condition, with necessary refrigeration and heat-treatment.

A quick look at the storage yard above shows how far this procedure has changed. *Now, up to 95% of all sheet parts can be successfully formed from ST material, as purchased from the mill!* Here's *MORE* evidence that HYDRA-CURVE Jaws lower manufacturing costs, increase parts production and save extra money by eliminating processing. Add to these advantages *actual material savings of up to 30%!* This conservation applies not only to aluminum, but, *even more important, to such costly metals as titanium and stainless steel.*

No doubt about it... *Hufford Stretch-Wrap Forming and HYDRA-CURVE Jaws are a winning combination!* Ask for details!



HYDRA-CURVE JAWS are a recent Hufford development reducing the amount of "stretch" required to form sheet parts. They greatly facilitate deep drawing operations as well as simplify production of lesser curvatures. HYDRA-CURVE Jaws are made for all Hufford sheet stretch-wrap forming machines and may be used on other types of stretch-forming presses.

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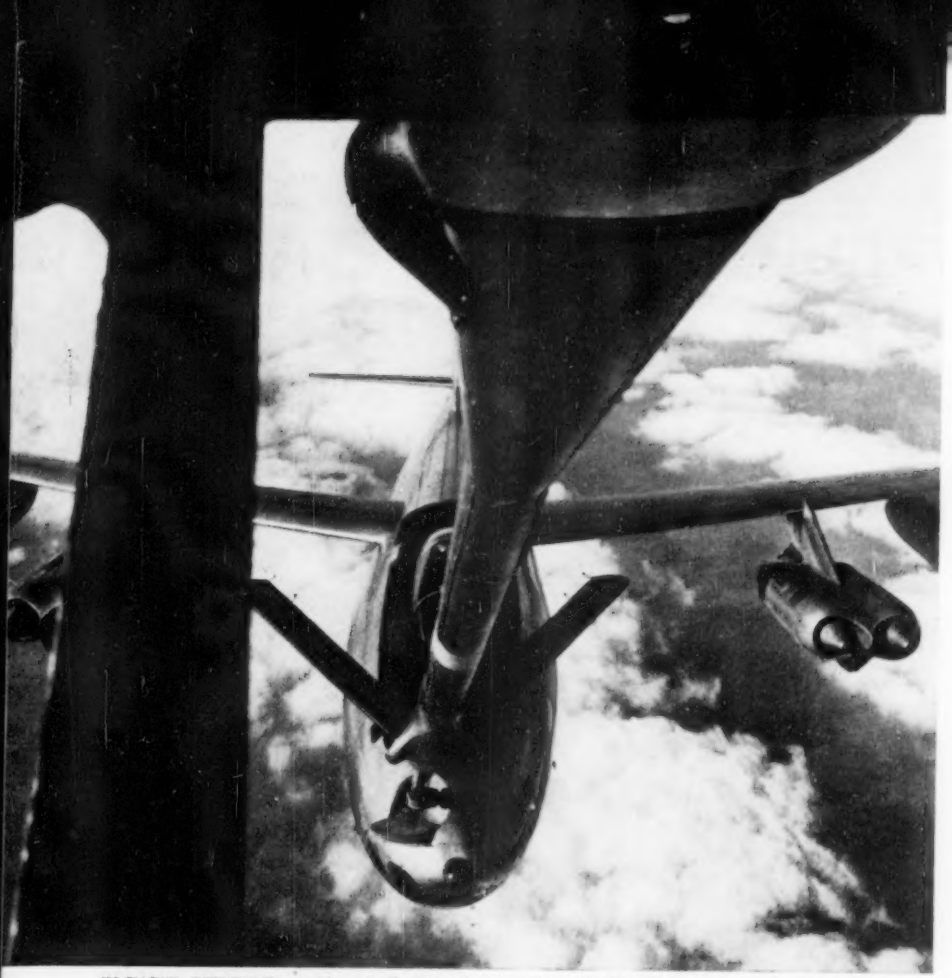

IN-FLIGHT REFUELING enables the B-47 to fly more than 12,000 miles non-stop. A vital factor in establishing rendezvous points is fuel consumption rate, measured on the B-47 by the G-E mass flowmeter.

Radically New G-E Fuel Flowmeter Gives True Mass Readings in Pounds per Hour

Jet engine fuel consumption can now be measured accurately at all operational altitudes and temperatures. A new kind of flowmeter, developed by General Electric, gives direct pounds-per-hour readings that are accurate regardless of density variations.

By measuring the mass of fuel consumed this revolutionary flowmeter averts the error factor inherent in earlier systems. It is the first true mass flowmeter in large-scale production.

In use on the B-47 Stratojet, the G-E mass flowmeter is proving its value as a cruise control instrument. The unusually long-range missions flown by the B-47 require utmost dependability in the indication of fuel consumption rate. The mass flowmeter also assures precise setting of fuel flow in starting engines, thereby helping to prevent overheating.

A complete mass flowmeter system has three lightweight components—indicator, transmitter, and a shock-mounted power supply. One power unit can supply as many as eight transmitters. Pressure drop in the transmitter is very slight, making possible two important advantages: (1) no additional fuel pumping capacity is needed; (2) the transmitter can be mounted in the low-pressure section of the fuel line near the fuselage.

For more information, ask your G-E Aviation Specialist for Bulletin GEC-932. Or write to Section 210-82, General Electric Company, Schenectady 5, New York.

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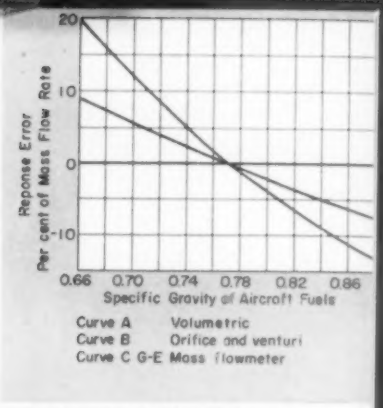

1. FUNDAMENTAL RESPONSE errors of the other two main types of flowmeter are contrasted with accurate response of G-E mass flowmeter.

2. INDICATOR has easy-to-read expanded scale that shows rate of fuel consumption in pounds per hour. Maximum weight: 0.6 lb.

3. TRANSMITTER gives readings up to 12,000 pph of mass flow. It will withstand 200 psi pressure. Maximum weight: 5.5 lb.

4. POWER SUPPLY has a 28-v constant-speed motor. Filters keep radio noises within Spec. MIL-I-6181. Maximum weight: 5.0 lb.